MATLAB® Coder™

Reference

MATLAB®

R2015b

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MATLAB® Coder™ Reference

Revision History

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Check Bug Reports for Issues and Fixes

Software is inherently complex and is not free of errors. The output of a code generator might contain bugs, some of which are not detected by a compiler. MathWorks reports critical known bugs brought to its attention on its Bug Report system at www.mathworks.com/support/bugreports/. Use the Saved Searches and Watched Bugs tool with the search phrase "Incorrect Code Generation" to obtain a report of known bugs that produce code that might compile and execute, but still produce wrong answers.

The bug reports are an integral part of the documentation for each release. Examine periodically all bug reports for a release, as such reports may identify inconsistencies between the actual behavior of a release you are using and the behavior described in this documentation.

In addition to reviewing bug reports, you should implement a verification and validation strategy to identify potential bugs in your design, code, and tools.

Contents

Apps — Alphabetical List

MATLAB Coder

Generate C code or MEX function from MATLAB code

Description

The **MATLAB Coder** app generates C or C++ code from MATLAB® code. You can generate:

- C or C++ source code, static libraries, dynamically linked libraries, and executables that you can integrate into existing C or C++ applications outside of MATLAB.
- MEX functions for accelerated versions of your MATLAB functions.

The workflow-based user interface steps you through the code generation process. Using the app, you can:

- Create a project or open an existing project. The project specifies the input files, entry-point function input types, and build configuration.
- Review code generation readiness issues, including unsupported functions.
- Check your MATLAB function for run-time issues.
- Fix issues in your MATLAB code using the integrated editor.
- Convert floating-point MATLAB code to fixed-point C code (requires a Fixed-Point Designer™ license).
- Convert double-precision MATLAB code to single-precision C code (requires a Fixed-Point Designer license).
- Trace from MATLAB code to generated C or C++ source code through comments.
- See static code metrics (requires an Embedded Coder® license).
- Verify the numerical behavior of generated code using software-in-the-loop and processor-in-the-loop execution (requires an Embedded Coder license).
- Export project settings in the form of a MATLAB script.
- Access generated files.
- Package generated files as a single zip file for deployment outside of MATLAB.

When the app creates a project, if the Embedded Coder product is installed, the app enables Embedded Coder features. When Embedded Coder features are enabled, code generation requires an Embedded Coder license. To disable Embedded Coder features, in the project build settings, on the **All Settings** tab, under **Advanced**, set **Use Embedded Coder features** to `No`.

Open the MATLAB Coder App

- MATLAB Toolstrip: On the **Apps** tab, under **Code Generation**, click the app icon.
- MATLAB command prompt: Enter `coder`.

Examples

- “C Code Generation Using the MATLAB Coder App”

Programmatic Use

`coder`

See Also

Apps
Fixed-Point Converter

Functions
`codegen`

Function Reference

codegen

Generate C/C++ code from MATLAB code

Syntax

```
codegen options files fcn_1 args... fcn_n args
codegen project_name
```

Description

`codegen options files fcn_1 args... fcn_n args` translates the MATLAB functions *`fcn_1`* through *`fcn_n`* to a C/C++ static or dynamic library, executable, or MEX function. Optionally, you can specify custom *`files`* to include in the build. `codegen` applies the *`options`* to functions *`fcn_1`* through *`fcn_n`*. It applies *`args`* to the preceding function only (*`fcn_n`*). If you specify C++, MATLAB Coder™ wraps the C code into .cpp files so that you can use a C++ compiler and interface with external C++ applications. It does not generate C++ classes.

`codegen project_name` generates output for the MATLAB Coder project `project_name`. `codegen` generates a MEX function, C/C++ static or dynamic library, or C/C++ executable depending on the project settings that you defined for `project_name`.

By default, `codegen` generates files in the folder `codegen/`*`target`*`/`*`fcn_name`*.

`target` can be:

- `mex` for MEX functions
- `exe` for embeddable C/C++ executables
- `lib` for embeddable C/C++ static libraries
- `dll` for C/C++ dynamic libraries

`fcn_name` is the name of the first MATLAB function (alphabetically) at the command line.

`codegen` copies the MEX function and executable file to the current working folder or to the output folder that the `-d` option specifies.

Each time `codegen` generates the same type of output for the same code or project, it removes the files from the previous build. If you want to preserve files from a previous build, before starting another build, copy them to a different location

Input Arguments

`args`

`args` applies only to the preceding function, *`fcn_n`*.

`-args` *`example_inputs`*	Define the size, class, and complexity of all MATLAB function inputs. Use the values in *`example_inputs`* to define these properties. *`example_inputs`* must be a cell array that specifies the same number and order of inputs as the MATLAB function. `codegen` interprets an empty cell array with the `-args` option to mean that the function takes no inputs. If the function does have inputs, a compile-time error occurs. Specify the example inputs immediately after the function to which they apply. Use the `coder.typeof` function to create example inputs.

`fcn_1`

`fcn_1... fcn_n` are the MATLAB entry-point functions from which to generate a MEX function, C/C++ library, or C/C++ executable code. In most cases, you have only one function. Make sure that *`fcn_1... fcn_n`* are suitable for code generation.

If these MATLAB functions are in files on a path that contains non 7-bit ASCII characters, such as Japanese characters, it is possible that `codegen` does not find them.

If you are using the LCC compiler, do not name an entry-point function `main`.

`files`

Space-separated list of custom files to include in generated code. You can include the following types of files:

- C file (`.c`)
- C++ file (`.cpp`)
- Header file (`.h`)
- Object file (`.o` or `.obj`)
- Library (`.a`, `.so`, or `.lib`)
- Template makefile (`.tmf`)

If these files are on a path that contains non 7-bit ASCII characters, such as Japanese characters, it is possible that `codegen` does not find them.

`options`

Choice of compiler options. `codegen` gives precedence to individual command-line options over options specified using a configuration object. If command-line options conflict, the rightmost option prevails.

`-c`	Generate C/C++ code, but do not invoke the `make` command.
`-config:dll`	Generate a dynamic C/C++ library using the default configuration parameters.
`-config:exe`	Generate a static C/C++ executable using the default configuration parameters.
`-config:lib`	Generate a static C/C++ library using the default configuration parameters.
`-config:mex`	Generate a MEX function using the default configuration parameters.
`-config:single`	Generate single-precision MATLAB code using the default configuration parameters. Requires a Fixed-Point Designer license.
`-config` *`config_object`*	Specify the configuration object that contains the code generation parameters. *`config_object`* is based on one of the following classes: • `coder.CodeConfig` — Parameters for standalone C/C++ library or executable generation if no Embedded Coder license is available.

```
% Configuration object for a dynamic linked library
cfg = coder.config('dll')
% Configuration object for an executable
cfg = coder.config('exe')
% Configuration object for a static standalone library
cfg = coder.config('lib')
```

- `coder.EmbeddedCodeConfig`— Parameters for a standalone C/C++ library or executable generation if an Embedded Coder license is available.

  ```
  % Configuration object for a dynamic linked library
  ec_cfg = coder.config('dll')
  % Configuration object for an executable
  ec_cfg = coder.config('exe')
  % Configuration object for a static standalone library
  ec_cfg = coder.config('lib')
  ```

- `coder.MexCodeConfig` — Parameters for MEX code generation.

  ```
  mex_cfg = coder.config
  % or
  mex_cfg = coder.config('mex')
  ```

`-d` *`out_folder`*

Store generated files in the absolute or relative path specified by *`out_folder`*. *`out_folder`* must not contain:

- Spaces, as spaces can lead to code generation failures in certain operating system configurations.
- Non 7-bit ASCII characters, such as Japanese characters,

If the folder specified by *`out_folder`* does not exist, `codegen` creates it.

If you do not specify the folder location, `codegen` generates files in the default folder:

`codegen/`*`target`*`/`*`fcn_name`*`.`

`target` can be:

- `mex` for MEX functions
- `exe` for embeddable C/C++ executables
- `lib` for embeddable C/C++ libraries
- `dll` for C/C++ dynamic libraries

`fcn_name` is the name of the first MATLAB function (alphabetically) at the command line.

The function does not support the following characters in folder names: asterisk (*), question-mark (?), dollar ($), and pound (#).

Note: Each time `codegen` generates the same type of output for the same code, it removes the files from the previous build. If you want to preserve files from a previous build, before starting another build, copy them to a different location.

`-doubles2single` *`double2single_cfg_name`*	Generates single-precision MATLAB code using the settings that the `coder.singleConfig` object *`double2single_cfg_name`* specifies. `codegen` generates files in the folder `codegen/`*`fcn_name`*`/single`. *`fcn_name`* is the name of the entry-point function. When used with the `-config` option, also generates single-precision C/C++ code. `codegen` generates the single-precision files in the folder `codegen/`*`target`*`/`*`folder_name`* . *`target`* can be: • `mex` for MEX functions • `exe` for embeddable C/C++ executables • `lib` for embeddable C/C++ libraries • `dll` for C/C++ dynamic libraries *`folder_name`* is the concatenation of *`fcn_name`* and *`singlesuffix`*. *`singlesuffix`* is the suffix that the `coder.singleConfig` property `OutputFileNameSuffix` specifies. The single-precision files in this folder also have this suffix. You must have a Fixed-Point Designer license to use this option.

`-float2fixed` *`float2fixed_cfg_name`*

When used with the `-config` option, generates fixed-point C/C++ code using the settings that the floating-point to fixed-point conversion configuration object *`float2fixed_cfg_name`* specifies.

`codegen` generates files in the folder `codegen/`*`target`*`/`*`fcn_name`*`_fixpt`. *`target`* can be:

- `mex` for MEX functions
- `exe` for embeddable C/C++ executables
- `lib` for embeddable C/C++ libraries
- `dll` for C/C++ dynamic libraries

`fcn_name` is the name of the entry-point function.

When used without the `-config` option, generates fixed-point MATLAB code using the settings that the floating-point to fixed-point conversion configuration object named *`float2fixed_cfg_name`* specifies. `codegen` generates files in the folder `codegen/`*`fcn_name`*`/fixpt`.

You must set the `TestBenchName` property of *`float2fixed_cfg_name`*. For example:

```
fixptcfg.TestBenchName = 'myadd_test';
```
specifies that `myadd_test` is the test file for the floating-point to fixed-point configuration object `fixptcfg`.

You must have a Fixed-Point Designer license to use this option.

`-g`	Specify whether to use the debug option for the C compiler. If you enable debug mode, the C compiler disables some optimizations. The compilation is faster, but the execution is slower.

`-globals` *`global_values`*	Specify names and initial values for global variables in MATLAB files.
	
	`global_values` is a cell array of global variable names and initial values. The format of `global_values` is:
	
	`{g1, init1, g2, init2, ..., gn, initn}`
	
	`gn` is the name of a global variable specified as a string. `initn` is the initial value. For example:
	
	`-globals {'g', 5}`
	
	Alternatively, use this format:
	
	`-globals {global_var, {type, initial_value}}`
	
	`type` is a type object. To create the type object, use `coder.typeof`. For global cell array variables, you must use this format.
	
	Before generating code with `codegen`, initialize global variables. If you do not provide initial values for global variables using the `-globals` option, `codegen` checks for the variable in the MATLAB global workspace. If you do not supply an initial value, `codegen` generates an error.
	
	MATLAB Coder and MATLAB each have their own copies of global data. For consistency, synchronize their global data whenever the two interact. If you do not synchronize the data, their global variables can differ.
	
	To specify a constant value for a global variable, use `coder.Constant`. For example:
	
	`-globals {'g', coder.Constant(v)}`
	specifies that `g` is a global variable with constant value `v`.

`-I` *`include_path`*	Add *`include_path`* to the beginning of the code generation path. When `codegen` searches for MATLAB functions and custom C/C++ files, it searches the code generation path first. It does not search for classes on the code generation path. Classes must be on the MATLAB search path. Spaces in *`include_path`* can lead to code generation failures in certain operating system configurations. If the path contains characters that are not 7-bit ASCII , such as Japanese characters, it is possible that `codegen` does not find files on this path.
`-launchreport`	Generate and open a code generation report. If you do not specify this option, `codegen` generates a report only if error or warning messages occur or if you specify the `-report` option.

`-o` *`output_file_name`*	Generate the MEX function, C/C++ library, or C/C++ executable file with the base name *`output_file_name`* plus an extension: • `.a` or `.lib` for C/C++ static libraries • `.exe` or no extension for C/C++ executables • `.dll` for C/C++ dynamic libraries on Microsoft® Windows® systems • `.so` for C/C++ dynamic libraries on Linux® and Macintosh systems • Platform-dependent extension for generated MEX functions *`output_file_name`* can be a file name or include an existing path. *`output_file_name`* must not contain spaces, as spaces can lead to code generation failures in certain operating system configurations. For MEX functions, *`output_file_name`* must be a valid MATLAB function name. If you do not specify an output file name for libraries and executables, the base name is *`fcn_1`*. *`fcn_1`* is the name of the first MATLAB function specified at the command line. For MEX functions, the base name is *`fcn_1_mex`*. You can run the original MATLAB function and the MEX function and compare the results.

`-O` *`optimization_option`*	Optimize generated code, based on the value of *`optimization_option`*: • `enable:inline` — Enable function inlining • `disable:inline` — Disable function inlining • `enable:openmp` — Use OpenMP library if available. Using the OpenMP library, the MEX functions or C/C++ code that `codegen` generates for `parfor`-loops can run on multiple threads. • `disable:openmp` — Disable OpenMP library. With OpenMP disabled, `codegen` treats `parfor`-loops as `for`-loops and generates a MEX function or C/C++ code that runs on a single thread. Specify `-O` at the command line once for each optimization. If not specified, `codegen` uses inlining and OpenMP for optimization.
`-report`	Generate a code generation report. If you do not specify this option, `codegen` generates a report only if error or warning messages occur or if you specify the `-launchreport` option. If you have an Embedded Coder license, this option also enables the Code Replacements and Static Code Metrics reports.
`-singleC`	Generate single-precision C/C++ code. You must have a Fixed-Point Designer license to use this option.
`-v`	Enable verbose mode to show build steps. Use when generating libraries or executables only.
`-?`	Display help for `codegen` command.

`project_name`

Name of the MATLAB Coder project that you want `codegen` to build. The project name must not contain spaces.

Examples

Generate a MEX function from a MATLAB function that is suitable for code generation.

1 Write a MATLAB function, `coderand`, that generates a random scalar value from the standard uniform distribution on the open interval (0,1).

```
function r = coderand() %#codegen
% The directive %#codegen indicates that the function
% is intended for code generation
r = rand();
```

2 Generate and run the MEX function. By default, `codegen` names the generated MEX function `coderand_mex`.

```
codegen coderand
coderand_mex
```

Generate C executable files from a MATLAB function that is suitable for code generation. Specify the main C function as a configuration parameter.

1 Write a MATLAB function, `coderand`, that generates a random scalar value from the standard uniform distribution on the open interval (0,1).

```
function r = coderand() %#codegen
r = rand();
```

2 Write a main C function, `c:\myfiles\main.c`, that calls `coderand`.

```
/*
** main.c
*/
#include <stdio.h>
#include <stdlib.h>
#include "coderand.h"
#include "coderand_initialize.h"
#include "coderand_terminate.h"
int main()
{
        coderand_initialize();

        printf("coderand=%g\n", coderand());

        coderand_terminate();

        return 0;
    }
```

3 Configure your code generation parameters to include the main C function, then generate the C executable.

   ```
   cfg = coder.config('exe')
   cfg.CustomSource = 'main.c'
   cfg.CustomInclude = 'c:\myfiles'
   codegen -config cfg coderand
   ```

   `codegen` generates a C executable, `coderand.exe`, in the current folder, and supporting files in the default folder, `codegen/exe/coderand`.

   This example shows how to specify a main function as a parameter in the configuration object `coder.CodeConfig`. Alternatively, you can specify the file containing `main()` separately at the command line. You can use a source, object, or library file.

Generate C library files in a custom folder from a MATLAB function with inputs of different classes and sizes. The first input is a 1-by-4 vector of unsigned 16-bit integers. The second input is a double-precision scalar.

1 Write a MATLAB function, `mcadd`, that returns the sum of two values.

   ```
   function y = mcadd(u,v) %#codegen
   y = u + v;
   ```

2 Generate the C library files in a custom folder `mcaddlib` using the `-config:lib` option.

   ```
   codegen -d mcaddlib -config:lib  mcadd -args {zeros(1,4,'uint16'),0}
   ```

Generate C library files from a MATLAB function that takes a fixed-point input.

1 Write a MATLAB language function, `mcsqrtfi`, that computes the square root of a fixed-point input.

   ```
   function y = mcsqrtfi(x) %#codegen
   ```

```
y = sqrt(x);
```

2 Define `numerictype` and `fimath` properties for the fixed-point input `x` and generate C library code for `mcsqrtfi` using the `-config:lib` option.

```
T = numerictype('WordLength',32, ...
                'FractionLength',23, ...
                'Signed',true)
F = fimath('SumMode','SpecifyPrecision', ...
           'SumWordLength',32, ...
           'SumFractionLength',23, ...
           'ProductMode','SpecifyPrecision', ...
           'ProductWordLength',32, ...
           'ProductFractionLength',23)
% Define a fixed-point variable with these
%  numerictype and fimath properties
myfiprops = {fi(4.0,T,F)}
codegen -config:lib mcsqrtfi -args myfiprops
```

`codegen` generates C library and supporting files in the default folder, `codegen/lib/mcsqrtfi`.

Specify global data at the command line.

1 Write a MATLAB function, `use_globals`, that takes one input parameter `u` and uses two global variables `AR` and `B`.

```
function y = use_globals(u)
%#codegen
% Turn off inlining to make
% generated code easier to read
coder.inline('never');
global AR;
global B;
AR(1) = u(1) + B(1);
y = AR * 2;
```

2 Generate a MEX function. By default, `codegen` generates a MEX function named `use_globals_mex` in the current folder. Specify the properties of the global variables at the command line by using the `-globals` option. Specify that input `u` is a real, scalar, double, by using the `-args` option.

```
codegen -globals {'AR', ones(4), 'B', [1 2 3 4]} ...
 use_globals -args {0}
```

Alternatively, you can initialize the global data in the MATLAB workspace. At the MATLAB prompt, enter:

```
global AR B;
AR = ones(4);
B=[1 2 3];
```
Compile the function to generate a MEX file named `use_globalsx`.

```
codegen use_globals -args {0}
```

Generate output for a MATLAB Coder project, `test_foo.prj`, that includes one file, `foo.m`, and has it output type set to C/C++ Static Library.

```
codegen test_foo.prj
```

`codegen` generates a C library, `foo`, in the `codegen\lib\foo` folder.

Generate a MEX function for a function, `displayState`, that has an input parameter that is an enumerated type.

1 Write a function, `displayState`, that uses enumerated data to activate an LED display, based on the state of a device. It lights a green LED display to indicate the ON state. It lights a red LED display to indicate the OFF state.

   ```
   function led = displayState(state)
   %#codegen

   if state == sysMode.ON
       led = LEDcolor.GREEN;
   else
       led = LEDcolor.RED;
   end
   ```
2 Define an enumeration `LEDColor`. On the MATLAB path, create a file named 'LEDColor' containing:

   ```
   classdef LEDcolor < int32
       enumeration
           GREEN(1),
           RED(2),
       end
   end
   ```
3 Create a `coder.EnumType` object using a value from an existing MATLAB enumeration.

a. Define an enumeration `sysMode`. On the MATLAB path, create a file named 'sysMode' containing:

   ```
   classdef sysMode < int32
     enumeration
       OFF(0)
       ON(1)
     end
   end
   ```

b. Create a `coder.EnumType` object from this enumeration.

   ```
   t = coder.typeof(sysMode.OFF);
   ```

4. Generate a MEX function for `displayState`.

   ```
   codegen  displayState -args {t}
   ```

Convert floating-point MATLAB code to fixed-point C code

This example requires a Fixed-Point Designer license.

1. Write a MATLAB function, `myadd`, that returns the sum of two values.

   ```
   function y = myadd(u,v) %#codegen
       y = u + v;
   end
   ```

2. Write a MATLAB function, `myadd_test`, to test `myadd`.

   ```
   function y = myadd_test %#codegen
       y = myadd(10,20);
   end
   ```

3. Create a `coder.FixptConfig` object, `fixptcfg`, with default settings.

   ```
   fixptcfg = coder.config('fixpt');
   ```

4. Set the test bench name.

   ```
   fixptcfg.TestBenchName = 'myadd_test';
   ```

5. Create a code generation configuration object to generate a standalone C static library.

   ```
   cfg = coder.config('lib');
   ```

6. Generate the code using the `-float2fixed` option.

```
    codegen -float2fixed fixptcfg -config cfg myadd
```

Convert double-precision MATLAB code to single-precision C code.

This example requires a Fixed-Point Designer license.

Suppose that `myfunction` takes two double scalar inputs. Use the `-singleC` option to generate single-precision C/C++ code.

```
codegen -singleC myfunction -args {1 2}
```

Alternatives

Use the `coder` function to open the MATLAB Coder app and create a MATLAB Coder project. The app provides a user interface that facilitates adding MATLAB files, defining input parameters, and specifying build parameters.

More About

- "Code Generation"
- "Primary Function Input Specification"
- "Specify Cell Array Inputs at the Command Line"
- "Specify Global Cell Arrays at the Command Line"
- "Specify a Language for Code Generation"
- "Paths and File Infrastructure Setup"
- "Generate Code for Global Data"
- "Synchronizing Global Data with MATLAB"
- "Generate Code for Multiple Entry-Point Functions"
- "Convert MATLAB Code to Fixed-Point C Code"
- "Generate Single-Precision C Code at the Command Line"
- "Generate Single-Precision MATLAB Code"
- "Control Compilation of parfor-Loops"

See Also

`coder` | `coder.typeof` | coder.EnumType | `parfor` | `fimath` | `numerictype` | `mex` | `fi` | `coder.runTest` | coder.FixptConfig

coder

Open MATLAB Coder app

Syntax

```
coder
coder projectname
coder -open projectname
coder -build projectname
coder -new projectname
coder -ecoder false -new projectname
coder -tocode projectname -script scriptname
coder -tocode projectname
```

Description

`coder` opens the MATLAB Coder app. To create a project, on the **Select Source Files** page, provide the entry-point file names. The app creates a project with a default name that is the name of the first entry-point file. To open an existing project, on the app toolbar, click ☰, and then click **Open existing project**.

If the Embedded Coder product is installed, when the app creates a project, it enables Embedded Coder features. When Embedded Coder features are enabled, code generation requires an Embedded Coder license. To disable Embedded Coder features, in the project build settings, on the **All Settings** tab, under **Advanced**, set **Use Embedded Coder features** to `No`.

`coder projectname` opens the MATLAB Coder app using the existing project named `projectname.prj`.

`coder -open projectname` opens the MATLAB Coder app using the existing project named `projectname.prj`.

`coder -build projectname` builds the existing project named `projectname.prj`.

`coder -new projectname` opens the MATLAB Coder app creating a project named `projectname.prj`. If the Embedded Coder product is installed, the app creates the project with Embedded Coder features enabled. To disable these features, in the project build settings, on the **All Settings** tab, under **Advanced**, set **Use Embedded Coder features** to `No`.

`coder -ecoder false -new projectname` opens the MATLAB Coder app creating a project named `projectname.prj`. The app creates the project with Embedded Coder features disabled even if the Embedded Coder product is installed.

`coder -tocode projectname -script scriptname` converts the existing project named `projectname.prj` to the equivalent script of MATLAB commands. The script is named `scriptname`.

- If `scriptname` exists, `coder` overwrites it.
- The script reproduces the project build configuration in a configuration object and builds the project. The script:
  - Creates a configuration object named `cfg`.
  - Defines the variable `ARGS` for function input types.
  - Defines the variable `GLOBALS` for global data initial values.
  - Runs the `codegen` command. When you run the script, the entry-point functions that are arguments to `codegen` must be on the search path.
- `cfg`, `ARGS`, and `GLOBALS` appear in the base workspace only after you run the script.

If the project includes automated fixed-point conversion, `coder` generates two scripts:

- A script `scriptname` that contains the MATLAB commands to:
  - Create a code configuration object that has the same settings as the project.
  - Run the `codegen` command to convert the fixed-point MATLAB function to a fixed-point C function.
- A script whose file name is a concatenation of the name specified by `scriptname` and the generated fixed-point file name suffix specified by the project file. If `scriptname` specifies a file extension, the script file name includes the file extension. For example, if `scriptname` is `myscript.m` and the suffix is the default value `_fixpt`, the script name is `myscript_fixpt.m`.

  This script contains the MATLAB commands to:

  - Create a floating-point to fixed-point conversion configuration object that has the same fixed-point conversion settings as the project.

- Run the `codegen` command to convert the floating-point MATLAB function to a fixed-point MATLAB function.

For a project that includes fixed-point conversion, before converting the project to scripts, complete the **Test Numerics** step of the fixed-point conversion process.

`coder -tocode projectname` converts the existing project named `projectname.prj` to the equivalent script of MATLAB commands. It writes the script to the Command Window.

Examples

Open an existing MATLAB Coder project

Open the MATLAB Coder app using the existing MATLAB Coder project named `my_coder_project`.

```
coder -open my_coder_project
```

Build a MATLAB Coder project

Build the MATLAB Coder project named `my_coder_project`.

```
coder -build my_coder_project
```

Create a MATLAB Coder project

Open the MATLAB Coder app and create a project named `my_coder_project`.

```
coder -new my_coder_project
```

Convert a MATLAB Coder project to a MATLAB script

Convert the MATLAB Coder project named `my_coder_project.prj` to the MATLAB script named `myscript.m`.

```
coder -tocode my_coder_project -script my_script.m
```

- "C Code Generation Using the MATLAB Coder App"
- "Convert MATLAB Coder Project to MATLAB Script"
- "Convert Fixed-Point Conversion Project to MATLAB Scripts"

- “Convert MATLAB Code to Fixed-Point C Code”

Input Arguments

`projectname` — Name of MATLAB Coder project
string

Name of MATLAB Coder project that you want to create, open, or build. The project name must not contain spaces.

`scriptname` — Name of script file
string

Name of script that you want to create when using the `-tocode` option with the `-script` option. The script name must not contain spaces.

Alternatives

- On the **Apps** tab, in the **Code Generation** section, click **MATLAB Coder**.
- Use the `codegen` function to generate code at the command line.

More About

Tips

- If you are sharing an Embedded Coder license, use `coder -ecoder false -new projectname` to create a project that does not require this license. If the Embedded Coder product is installed, the app creates the project with Embedded Coder features disabled. When these features are disabled, code generation does not require an Embedded Coder license. To enable Embedded Coder features, in the project build settings, on the **All Settings** tab, under **Advanced**, set **Use Embedded Coder features** to `Yes`.
- Creating a project or opening an existing project causes other MATLAB Coder or Fixed-Point Converter projects to close.
- If your installation does not include the Embedded Coder product, the Embedded Coder settings do not show. However, values for these settings are saved in the

project file. If you open the project in an installation that includes the Embedded Coder product, you see these settings.

- A Fixed-Point Converter project opens in the Fixed-Point Converter app. To convert the project to a MATLAB Coder project, in the Fixed-Point Converter app:

  1. Click ☰ and select **Reopen project as**.
  2. Select `MATLAB Coder`.

See Also

`codegen` | MATLAB Coder

coder.allowpcode

Package: coder

Control code generation from protected MATLAB files

Syntax

```
coder.allowpcode('plain')
```

Description

`coder.allowpcode('plain')` allows you to generate protected MATLAB code (P-code) that you can then compile into optimized MEX functions or embeddable C/C++ code. This function does not obfuscate the generated MEX functions or embeddable C/C++ code.

With this capability, you can distribute algorithms as protected P-files that provide code generation optimizations, providing intellectual property protection for your source MATLAB code.

Call this function in the top-level function before control-flow statements, such as `if`, `while`, `switch`, and function calls.

MATLAB functions can call P-code. When the `.m` and `.p` versions of a file exist in the same folder, the P-file takes precedence.

`coder.allowpcode` is ignored outside of code generation.

Examples

Generate optimized embeddable code from protected MATLAB code:

1 Write an function `p_abs` that returns the absolute value of its input:

   ```
   function out = p_abs(in)   %#codegen
   % The directive %#codegen indicates that the function
   % is intended for code generation
   ```

```
coder.allowpcode('plain');
out = abs(in);
```

2 Generate protected P-code. At the MATLAB prompt, enter:

```
pcode p_abs
```

The P-file, `p_abs.p`, appears in the current folder.

3 Generate a MEX function for `p_abs.p`, using the `-args` option to specify the size, class, and complexity of the input parameter (requires a MATLAB Coder license). At the MATLAB prompt, enter:

```
codegen p_abs -args { int32(0) }
```

`codegen` generates a MEX function in the current folder.

4 Generate embeddable C code for `p_abs.p` (requires a MATLAB Coder license). At the MATLAB prompt, enter:

```
codegen p_abs -config:lib -args { int32(0) };
```

`codegen` generates C library code in the `codegen\lib\p_abs` folder.

More About

- "Compilation Directive %#codegen"

See Also

`pcode` | `codegen`

Introduced in R2011a

coder.approximation

Create function replacement configuration object

Syntax

```
q = coder.approximation(function_name)
q = coder.approximation('Function',function_name,Name,Value)
```

Description

`q = coder.approximation(function_name)` creates a function replacement configuration object for use during code generation or fixed-point conversion. The configuration object specifies how to create a lookup table approximation for the MATLAB function specified by `function_name`. To associate this approximation with a `coder.FixptConfig` object for use with the`codegen` function, use the `coder.FixptConfig` configuration object `addApproximation` method.

Use this syntax only for the functions that `coder.approximation` can replace automatically. These functions are listed in the `function_name` argument description.

`q = coder.approximation('Function',function_name,Name,Value)` creates a function replacement configuration object using additional options specified by one or more name-value pair arguments.

Examples

Replace `log` Function with Default Lookup Table

Create a function replacement configuration object using the default settings. The resulting lookup table in the generated code uses 1000 points.

```
logAppx = coder.approximation('log');
```

Replace `log` Function with Uniform Lookup Table

Create a function replacement configuration object. Specify the input range and prefix to add to the replacement function name. The resulting lookup table in the generated code uses 1000 points.

```
logAppx = coder.approximation('Function','log','InputRange',[0.1,1000],...
'FunctionNamePrefix','log_replace_');
```

Replace `log` Function with Optimized Lookup Table

Create a function replacement configuration object using the `'OptimizeLUTSize'` option to specify to replace the `log` function with an optimized lookup table. The resulting lookup table in the generated code uses less than the default number of points.

```
 logAppx = coder.approximation('Function','log','OptimizeLUTSize', true,...
'InputRange',[0.1,1000],'InterpolationDegree',1,'ErrorThreshold',1e-3,...
'FunctionNamePrefix','log_optim_','OptimizeIterations',25);
```

Replace Custom Function with Optimized Lookup Table

Create a function replacement configuration object that specifies to replace the custom function, `saturateExp`, with an optimized lookup table.

Create a custom function, `saturateExp`.

```
saturateExp = @(x) 1/(1+exp(-x));
```

Create a function replacement configuration object that specifies to replace the `saturateExp` function with an optimized lookup table. Because the `saturateExp` function is not listed as a function for which `coder.approximation` can generate an approximation automatically, you must specify the `CandidateFunction` property.

```
saturateExp = @(x) 1/(1+exp(-x));
custAppx = coder.approximation('Function','saturateExp',...
'CandidateFunction', saturateExp,...
'NumberOfPoints',50,'InputRange',[0,10]);
```

- “Replace the exp Function with a Lookup Table”
- “Replace a Custom Function with a Lookup Table”

Input Arguments

`function_name` — Name of the function to replace

`'acos'` | `'acosd'` | `'acosh'` | `'acoth'` | `'asin'` | `'asind'` | `'asinh'` | `'atan'` | `'atand'` | `'atanh'` | `'cos'` | `'cosd'` | `'cosh'` | `'erf '` | `'erfc'`

| `'exp'` | `'log'` | `'normcdf'` | `'reallog'` | `'realsqrt'` | `'reciprocal'` | `'rsqrt'` | `'sin'` | `'sinc'` | `'sind'` | `'sinh'` | `'sqrt'` | `'tan'` | `'tand'`

Name of function to replace, specified as a string. The function must be one of the listed functions.

Example: `'sqrt'`

Data Types: `char`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside single quotes (`' '`). You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

Example: `'Function', 'log'`

`'Architecture'` — Architecture of lookup table approximation

`'LookupTable'` (default) | `'Flat'`

Architecture of the lookup table approximation, specified as the comma-separated pair consisting of `'Architecture'` and a string. Use this argument when you want to specify the architecture for the lookup table. The `Flat` architecture does not use interpolation.

Data Types: `char`

`'CandidateFunction'` — Function handle of the replacement function

function handle | string

Function handle of the replacement function, specified as the comma-separated pair consisting of `'CandidateFunction'` and a function handle or string referring to a function handle. Use this argument when the function that you want to replace is not listed under `function_name`. Specify the function handle or string referring to a function handle of the function that you want to replace. You can define the function in a file or as an anonymous function.

If you do not specify a candidate function, then the function you chose to replace using the `Function` property is set as the `CandidateFunction`.

Example: `'CandidateFunction', @(x) (1./(1+x))`

Data Types: `function_handle` | `char`

`'ErrorThreshold'` — Error threshold value used to calculate optimal lookup table size
0.001 (default) | nonnegative scalar

Error threshold value used to calculate optimal lookup table size, specified as the comma-separated pair consisting of `'ErrorThreshold'` and a nonnegative scalar. If `'OptimizeLUTSize'` is `true`, this argument is required.

`'Function'` — Name of function to replace with a lookup table approximation
`function_name`

Name of function to replace with a lookup table approximation, specified as the comma-separated pair consisting of `'Function'` and a string. The function must be continuous and stateless. If you specify one of the functions that is listed under `function_name`, the conversion process automatically provides a replacement function. Otherwise, you must also specify the `'CandidateFunction'` argument for the function that you want to replace.

Example: `'Function','log'`

Example: `'Function', 'my_log',‘CandidateFunction’,@my_log`

Data Types: `char`

`'FunctionNamePrefix'` — Prefix for generated fixed-point function names
'replacement_' (default) | string

Prefix for generated fixed-point function names, specified as the comma-separated pair consisting of `'FunctionNamePrefix'` and a string. The name of a generated function consists of this prefix, followed by the original MATLAB function name.

Example: ‘log_replace_’

`'InputRange'` — Range over which to replace the function
[ ] (default) | 2x1 row vector | 2xN matrix

Range over which to replace the function, specified as the comma-separated pair consisting of `'InputRange'` and a 2-by-1 row vector or a 2-by-*N* matrix.

Example: `[-1 1]`

`'InterpolationDegree'` — Interpolation degree
`1` (default) | `0` | `2` | `3`

Interpolation degree, specified as the comma-separated pair consisting of `'InterpolationDegree'` and`1` (linear), `0` (none), `2` (quadratic), or `3` (cubic).

`'NumberOfPoints'` — Number of points in lookup table
`1000` (default) | positive integer

Number of points in lookup table, specified as the comma-separated pair consisting of `'NumberOfPoints'` and a positive integer.

`'OptimizeIterations'` — Number of iterations
25 (default) | positive integer

Number of iterations to run when optimizing the size of the lookup table, specified as the comma-separated pair consisting of `'OptimizeIterations'` and a positive integer.

`'OptimizeLUTSize'` — Optimize lookup table size
`false` (default) | `true`

Optimize lookup table size, specified as the comma-separated pair consisting of `'OptimizeLUTSize'` and a logical value. Setting this property to `true` generates an area-optimal lookup table, that is, the lookup table with the minimum possible number of points. This lookup table is optimized for size, but might not be speed efficient.

`'PipelinedArchitecture'` — Option to enable pipelining
`false` (default) | `true`

Option to enable pipelining, specified as the comma-separated pair consisting of `'PipelinedArchitecture'` and a logical value.

Output Arguments

q — Function replacement configuration object, returned as a `coder.mathfcngenerator.LookupTable` or a `coder.mathfcngenerator.Flat` configuration object
`coder.mathfcngenerator.LookupTable` configuration object | `coder.mathfcngenerator.Flat` configuration object

Function replacement configuration object. Use the `coder.FixptConfig` configuration object `addApproximation` method to associate this configuration object with a `coder.FixptConfig` object. Then use the `codegen` function `-float2fixed` option with `coder.FixptConfig` to convert floating-point MATLAB code to fixed-point code.

Property	Default Value
`Auto-replace function`	`''`
`InputRange`	`[]`
`FunctionNamePrefix`	`'replacement_'`
`Architecture`	`LookupTable` (read only)
`NumberOfPoints`	`1000`
`InterpolationDegree`	`1`
`ErrorThreshold`	`0.001`
`OptimizeLUTSize`	`false`
`OptimizeIterations`	`25`

More About

- "Replacing Functions Using Lookup Table Approximations"

See Also

Classes
coder.FixptConfig

Functions
`codegen`

coder.ceval

Package: coder

Call external C/C++ function

Syntax

```
coder.ceval('cfun_name')
coder.ceval('cfun_name', cfun_arguments)
cfun_return = coder.ceval('cfun_name')
cfun_return = coder.ceval('cfun_name', cfun_arguments)
coder.ceval('-global','cfun_name',cfun_arguments)
cfun_return=coder.ceval('-global','cfun_name',cfun_arguments)
```

Description

`coder.ceval('`*`cfun_name`*`')` executes the external C/C++ function specified by the quoted string *`cfun_name`*. Define *`cfun_name`* in an external C/C++ source file or library.

`coder.ceval('`*`cfun_name`*`', `*`cfun_arguments`*`)` executes *`cfun_name`* with arguments *`cfun_arguments`*. *`cfun_arguments`* is a comma-separated list of input arguments in the order that *`cfun_name`* requires.

`cfun_return = coder.ceval('`*`cfun_name`*`')` executes *`cfun_name`* and returns a single scalar value, *`cfun_return`*, corresponding to the value that the C/C++ function returns in the `return` statement. To be consistent with C/C++, `coder.ceval` can return only a scalar value; it cannot return an array.

`cfun_return = coder.ceval('`*`cfun_name`*`', `*`cfun_arguments`*`)` executes *`cfun_name`* with arguments *`cfun_arguments`* and returns *`cfun_return`*.

`coder.ceval('-global','`*`cfun_name`*`',`*`cfun_arguments`*`)`

`cfun_return=coder.ceval('-global','`*`cfun_name`*`',`*`cfun_arguments`*`)`

For code generation, you must specify the type, size, and complexity data type of return values and output arguments before calling `coder.ceval`.

By default, `coder.ceval` passes arguments by value to the C/C++ function whenever C/C++ supports passing arguments by value. To make `coder.ceval` pass arguments by reference, use the constructs `coder.ref`, `coder.rref`, and `coder.wref`. If C/C ++ does not support passing arguments by value, for example, if the argument is an array, `coder.ceval` passes arguments by reference. In this case, if you do not use the `coder.ref`, `coder.rref`, and `coder.wref` constructs, a copy of the argument might appear in the generated code to enforce MATLAB semantics for arrays.

If you pass a global variable by reference using `coder.ref`, `coder.rref` or `coder.wref`, and the custom C code saves the address of this global variable, use the `-global` flag to synchronize for the variables passed to the custom C code. Synchronization occurs before and after calls to the custom code. If you do not synchronize global variables under these circumstances and the custom C code saves the address and accesses it again later, the value of the variable might be out of date.

Note: The `-global` flag does not apply for MATLAB Function blocks.

You cannot use `coder.ceval` on functions that you declare extrinsic with `coder.extrinsic`.

Use `coder.ceval` only in MATLAB for code generation. `coder.ceval` generates an error in uncompiled MATLAB code. Use `coder.target` to determine if the MATLAB function is executing in MATLAB. If it is, do not use `coder.ceval` to call the C/C++ function. Instead, call the MATLAB version of the C/C++ function.

When the LCC compiler creates a library, it adds a leading underscore to the library function names. If the compiler for the library was LCC and your code generation compiler is not LCC, you must add the leading underscore to the function name in a `coder.ceval` call. For example, `coder.ceval('_mylibfun')`. If the compiler for a library was not LCC, you cannot use LCC to generate code from MATLAB code that calls functions from that library. Those library function names do not have the leading underscore that the LCC compiler requires.

Examples

Call a C function `foo(u)` from a MATLAB function from which you intend to generate C code:

1 Create a C header file foo.h for a function foo that takes two input parameters of type double and returns a value of type double.

```
#ifdef MATLAB_MEX_FILE
#include <tmwtypes.h>
#else
#include "rtwtypes.h"
#endif

double foo(double in1, double in2);
```

2 Write the C function foo.c.

```
#include <stdio.h>
#include <stdlib.h>
#include "foo.h"

double foo(double in1, double in2)
{
  return in1 + in2;
}
```

3 Write a function callfoo that calls foo using coder.ceval.

```
function y = callfoo  %#codegen
y = 0.0;
if coder.target('MATLAB')
    % Executing in MATLAB, call MATLAB equivalent of
    % C function foo
    y = 10 + 20;
else
    % Executing in generated code, call C function foo
    y = coder.ceval('foo', 10, 20);
end
end
```

4 Generate C library code for function callfoo, passing foo.c and foo.h as parameters to include this custom C function in the generated code.

```
codegen -config:lib callfoo foo.c foo.h
```

codegen generates C code in the codegen\lib\callfoo subfolder.

```
double callfoo(void)
{
  /*  Executing in generated code, call C function foo */
  return foo(10.0, 20.0);
}
```

In this case, you have not specified the type of the input arguments, that is, the type of the constants `10` and `20`. Therefore, the arguments are implicitly of double-precision, floating-point type by default, because the default type for constants in MATLAB is `double`.

Call a C library function from MATLAB code:

1. Write a MATLAB function `absval`.

   ```
   function y = absval(u)   %#codegen
   y = abs(u);
   ```
2. Generate the C library for `absval.m`, using the `-args` option to specify the size, type, and complexity of the input parameter.

   ```
   codegen -config:lib absval -args {0.0}
   ```
   `codegen` creates the library `absval.lib` and header file `absval.h` in the folder `/codegen/lib/absval`. It also generates the functions `absval_initialize` and `absval_terminate` in the same folder.
3. Write a MATLAB function to call the generated C library functions using `coder.ceval`.

   ```
   function y = callabsval  %#codegen
   y = -2.75;
   % Check the target. Do not use coder.ceval if callabsval is
   % executing in MATLAB
   if coder.target('MATLAB')
     % Executing in MATLAB, call function absval
     y = absval(y);
   else
     % Executing in the generated code.
     % Call the initialize function before calling the
     % C function for the first time
     coder.ceval('absval_initialize');

     % Call the generated C library function absval
     y = coder.ceval('absval',y);

     % Call the terminate function after
     % calling the C function for the last time
     coder.ceval('absval_terminate');
   end
   ```

4 Convert the code in `callabsval.m` to a MEX function so you can call the C library function `absval` directly from MATLAB.

```
codegen -config:mex callabsval codegen/lib/absval/absval.lib...
     codegen/lib/absval/absval.h
```

5 Call the C library by running the MEX function from MATLAB.

```
callabsval_mex
```

More About

- “Compilation Directive %#codegen”
- “External Code Integration”
- “Data Definition Basics”

See Also

`coder.ref` | `coder.rref` | `coder.wref` | `coder.target` | `codegen` | | | `coder.extrinsic` | | |

Introduced in R2011a

coder.cinclude

Include header file in generated code

Syntax

```
coder.cinclude(AppHeaderFile)
coder.cinclude(SysHeaderFile)
```

Description

`coder.cinclude(AppHeaderFile)` includes an application header file in generated code using this format:

```
#include "HeaderFile"
```

`coder.cinclude(SysHeaderFile)` includes a system header file in generated code using this format:

```
#include <HeaderFile>
```

Examples

Include Header File Conditionally in Generated Code

Generate code from a MATLAB function that calls an external C function to double its input. The MATLAB function uses `coder.cinclude` to include an application header file in generated C code running on a target machine, but not when the function runs in the MATLAB environment.

Write a C function `myMult2.c` that doubles its input. Save it in a subfolder `mycfiles`.

```
#include "myMult2.h"
double myMult2(double u)
{
    return 2 * u;
}
```

Write the application header file `myMult2.h`. Save it in the subfolder `mycfiles`.

```
#if !defined(MYMULT2)
#define MYMULT2
extern double myMult2(double);
#endif
```

Write a MATLAB function that conditionally includes the application header file and calls the external C function.

```
function y = myfunc
%#codegen
    y = 21;
    if ~coder.target('MATLAB')
    % Running in generated code
        coder.cinclude('myMult2.h');
        y = coder.ceval('myMult2', y);
    else
    % Running in MATLAB
        y = y * 2;
    end
end
```

Compile the MATLAB function. Use the `-I` option to specify the path to the external header and C files.

```
codegen -config:lib myfunc -I mycfiles
```

Here is the generated C code:

```
/* Include files */
#include "rt_nonfinite.h"
#include "myfunc.h"
#include "myMult2.h"

/* Function Definitions */
double myfunc(void)
{
  /*  Running in generated code */
  return myMult2(21.0);
}

/* End of code generation (myfunc.c) */
```

Besides the files that `coder.cinclude` specifies, `codegen` automatically includes the following files:

- Header file that defines the prototype for your entry-point function (in this case, `myMult2.h`)
- `rt_nonfinite.h` (if you do not specify `SupportNonFinite=false` using `coder.config` when you compile the entry-point function).

Input Arguments

`AppHeaderFile` — Name of application header file

string

Name of an application header file, specified as a string. The header file must be located in the include path that you specify with the `-I` option when generating code using `codegen`.

Example: `coder.cinclude('myheader.h')`

Data Types: `char`

`SysHeaderFile` — Name of system header file

string

Name of a system header file, specified as a string enclosed in angle brackets `< >`. The header file must come from a standard list of system directories or from the include path that you specify with the `-I` option when generating code using `codegen`.

Example: `coder.cinclude('<stdio.h>')`

Data Types: `char`

Limitations

- Do not call `coder.cinclude` inside run-time conditional constructs such as `if` statements, `switch` statements, `while`-loops, and `for`-loops. However, you can call `coder.cinclude` inside compile-time conditional statements, such as `coder.target`. For example:

  ```
  ...
  ```

```
     if ~coder.target('MATLAB')
       coder.cinclude('foo.h');
       coder.ceval('foo');
   end
   ...
```

More About

Tips

- Call `coder.cinclude` before calling an external C/C++ function using `coder.ceval` to include in the generated code the header files required for the external function.
- Localize use of `coder.cinclude` at the call sites where you want to include each header file. Do not place all of your `coder.cinclude` calls in the top-level (entry-point) function unless you want to include the specified header files in every build.

See Also

`codegen` | `coder.ceval` | `coder.config` | `coder.target`

Introduced in R2013a

coder.config

Package: coder

Create MATLAB Coder code generation configuration objects

Syntax

```
config_obj = coder.config
config_obj = coder.config('mex')
config_obj = coder.config('lib')
config_obj = coder.config('dll')
config_obj = coder.config('exe')
config_obj = coder.config(c_output_type,'ecoder',false)
config_obj = coder.config(c_output_type,'ecoder',true)
config_obj = coder.config('fixpt')
config_obj = coder.config('single')
```

Description

`config_obj = coder.config` creates a `coder.MexCodeConfig` code generation configuration object for use with `codegen` when generating a MEX function.

`config_obj = coder.config('mex')` creates a `coder.MexCodeConfig` code generation configuration object for use with `codegen` when generating a MEX function.

`config_obj = coder.config('lib')` creates a code generation configuration object for use with `codegen` when generating a C/C++ static library. If the Embedded Coder product is installed, it creates a `coder.EmbeddedCodeConfig` object. Otherwise, it creates a `coder.CodeConfig` configuration object.

`config_obj = coder.config('dll')` creates a code generation configuration object for use with `codegen` when generating a C/C++ dynamic library. If the Embedded Coder product is installed, it creates a `coder.EmbeddedCodeConfig` object. Otherwise, it creates a `coder.CodeConfig` configuration object.

`config_obj = coder.config('exe')` creates a code generation configuration object for use with `codegen` when generating a C/C++ executable. If the Embedded Coder product is installed, it creates a `coder.EmbeddedCodeConfig` object. Otherwise, it creates a `coder.CodeConfig` configuration object.

`config_obj = coder.config(`*`c_output_type`*`,'ecoder',false)` creates a `coder.CodeConfig` configuration object to generate *`c_output_type`* even if the Embedded Coder product is installed. *`c_output_type`* is `'lib'`, `'dll'`, or `'exe'`.

`config_obj = coder.config(`*`c_output_type`*`,'ecoder',true)` creates a `coder.EmbeddedCodeConfig` configuration object to generate *`c_output_type`* even if the Embedded Coder product is not installed. However, code generation using a `coder.EmbeddedCodeConfig` object requires an Embedded Coder license. *`c_output_type`* is `'lib'`, `'dll'`, or `'exe'`.

`config_obj = coder.config('fixpt')` creates a `coder.FixptConfig` configuration object for use with `codegen` when generating fixed-point C/C++ code from floating-point MATLAB code. Creation of a `coder.FixptConfig` code configuration object requires the Fixed-Point Designer product.

`config_obj = coder.config('single')` creates a `coder.SingleConfig` configuration object for use with `codegen` when generating single-precision MATLAB code from double-precision MATLAB code. Creation of a `coder.SingleConfig` code configuration object requires the Fixed-Point Designer product.

Examples

Generate a MEX function from a MATLAB function that is suitable for code generation and enable a code generation report.

1 Write a MATLAB function, `coderand`, that generates a random scalar value from the standard uniform distribution on the open interval (0,1).

```
function r = coderand() %#codegen
% The directive %#codegen declares that the function
% is intended for code generation
r = rand();
```

2 Create a code generation configuration object to generate a MEX function.

```
cfg = coder.config % or cfg = coder.config('mex')
```

3 Enable the code generation report.

```
cfg.GenerateReport = true;
```

4 Generate a MEX function in the current folder specifying the configuration object using the `-config` option.

```
% Generate a MEX function and code generation report
codegen -config cfg coderand
```

Create a code generation configuration object to generate a standalone C static library.

```
cfg = coder.config('lib')
% Returns a coder.EmbeddedCodeConfig object if the Embedded
% Coder product is installed.
% Otherwise, returns a coder.CodeConfig object.
```

Create a code generation configuration object to generate a standalone C dynamic library.

```
cfg = coder.config('dll')
% Returns a coder.EmbeddedCodeConfig object if the Embedded
% Coder product is installed.
% Otherwise, returns a coder.CodeConfig object.
```

Create a code generation configuration object to generate a standalone C executable.

```
cfg = coder.config('exe')
% Returns a coder.EmbeddedCodeConfig object if the Embedded
% Coder product is installed.
% Otherwise, returns a coder.CodeConfig object.
```

Create a `coder.CodeConfig` object even if the Embedded Coder product is installed .

```
cfg = coder.config('lib','ecoder',false)
% Returns a coder.CodeConfig object even if the Embedded
% Coder product is installed.
```

Create a floating-point to fixed-point conversion configuration object.

```
fixptcfg = coder.config('fixpt');
% Returns a coder.FixptConfig object
```

Create a double-precision to single-precision conversion configuration object.

```
scfg = coder.config('single');
% Returns a coder.SingleConfig object
```

Alternatives

Use the `coder` function to open the MATLAB Coder app and create a MATLAB Coder project. The app provides a user interface that facilitates adding MATLAB files, defining input parameters, and specifying build parameters.

See Also

coder.MexCodeConfig | coder.CodeConfig | coder.EmbeddedCodeConfig | coder.FixptConfig | `codegen`

coder.const

Fold expressions into constants in generated code

Syntax

```
out = coder.const(expression)
[out1,...,outN] = coder.const(handle,arg1,...,argN)
```

Description

`out = coder.const(expression)` evaluates `expression` and replaces `out` with the result of the evaluation in generated code.

`[out1,...,outN] = coder.const(handle,arg1,...,argN)` evaluates the multi-output function having handle `handle`. It then replaces `out1,...,outN` with the results of the evaluation in the generated code.

Examples

Specify Constants in Generated Code

This example shows how to specify constants in generated code using `coder.const`.

Write a function `AddShift` that takes an input `Shift` and adds it to the elements of a vector. The vector consists of the square of the first 10 natural numbers. `AddShift` generates this vector.

```
function y = AddShift(Shift) %#codegen
y = (1:10).^2+Shift;
```

Generate code for `AddShift` using the `codegen` command. Open the Code Generation Report.

```
codegen -config:lib -launchreport AddShift -args 0
```

The code generation software generates code for creating the vector. It adds `Shift` to each element of the vector during vector creation. The definition of `AddShift` in generated code looks as follows:

```
void AddShift(double Shift, double y[10])
{
  int k;
  for (k = 0; k < 10; k++) {
    y[k] = (double)((1 + k) * (1 + k)) + Shift;
  }
}
```

Replace the statement

```
y = (1:10).^2+Shift;
```

with

```
y = coder.const((1:10).^2)+Shift;
```

Generate code for `AddShift` using the `codegen` command. Open the Code Generation Report.

```
codegen -config:lib -launchreport AddShift -args 0
```

The code generation software creates the vector containing the squares of the first 10 natural numbers. In the generated code, it adds `Shift` to each element of this vector. The definition of `AddShift` in generated code looks as follows:

```
void AddShift(double Shift, double y[10])
{
  int i0;
  static const signed char iv0[10] = { 1, 4, 9, 16, 25, 36,
                                49, 64, 81, 100 };

  for (i0 = 0; i0 < 10; i0++) {
    y[i0] = (double)iv0[i0] + Shift;
  }
}
```

Create Lookup Table in Generated Code

This example shows how to fold a user-written function into a constant in generated code.

Write a function `getsine` that takes an input `index` and returns the element referred to by `index` from a lookup table of sines. The function `getsine` creates the lookup table using another function `gettable`.

```
function y = getsine(index) %#codegen
  assert(isa(index, 'int32'));
  persistent tbl;
  if isempty(tbl)
           tbl = gettable(1024);
  end
  y = tbl(index);

function y = gettable(n)
      y = zeros(1,n);
      for i = 1:n
         y(i) = sin((i-1)/(2*pi*n));
      end
```

Generate code for `getsine` using an argument of type `int32`. Open the Code Generation Report.

```
codegen -config:lib -launchreport getsine -args int32(0)
```

The generated code contains instructions for creating the lookup table.

Replace the statement:

```
tbl = gettable(1024);
```

with:

```
tbl = coder.const(gettable(1024));
```

Generate code for `getsine` using an argument of type `int32`. Open the Code Generation Report.

The generated code contains the lookup table itself. `coder.const` forces the expression `gettable(1024)` to be evaluated during code generation. The generated code does not contain instructions for the evaluation. The generated code contains the result of the evaluation itself.

Specify Constants in Generated Code Using Multi-Output Function

This example shows how to specify constants in generated code using a multi-output function in a `coder.const` statement.

Write a function `MultiplyConst` that takes an input `factor` and multiplies every element of two vectors `vec1` and `vec2` with `factor`. The function generates `vec1` and `vec2` using another function `EvalConsts`.

```
function [y1,y2] = MultiplyConst(factor) %#codegen
  [vec1,vec2]=EvalConsts(pi.*(1./2.^(1:10)),2);
  y1=vec1.*factor;
  y2=vec2.*factor;

function [f1,f2]=EvalConsts(z,n)
  f1=z.^(2*n)/factorial(2*n);
  f2=z.^(2*n+1)/factorial(2*n+1);
```

Generate code for `MultiplyConst` using the `codegen` command. Open the Code Generation Report.

```
codegen -config:lib -launchreport MultiplyConst -args 0
```

The code generation software generates code for creating the vectors.

Replace the statement

```
[vec1,vec2]=EvalConsts(pi.*(1./2.^(1:10)),2);
```

with

```
[vec1,vec2]=coder.const(@EvalConsts,pi.*(1./2.^(1:10)),2);
```

Generate code for `MultiplyConst` using the `codegen` command. Open the Code Generation Report.

```
codegen -config:lib -launchreport MultiplyConst -args 0
```

The code generation software does not generate code for creating the vectors. Instead, it calculates the vectors and specifies the calculated vectors in generated code.

Read Constants by Processing XML File

This example shows how to call an extrinsic function using `coder.const`.

Write an XML file `MyParams.xml` containing the following statements:

```
<params>
    <param name="hello" value="17"/>
    <param name="world" value="42"/>
```

```
</params>
```

Save `MyParams.xml` in the current folder.

Write a MATLAB function `xml2struct` that reads an XML file. The function identifies the XML tag `param` inside another tag `params`.

After identifying `param`, the function assigns the value of its attribute `name` to the field name of a structure `s`. The function also assigns the value of attribute `value` to the value of the field.

```
function s = xml2struct(file)

s = struct();
doc = xmlread(file);
els = doc.getElementsByTagName('params');
for i = 0:els.getLength-1
    it = els.item(i);
    ps = it.getElementsByTagName('param');
    for j = 0:ps.getLength-1
        param = ps.item(j);
        paramName = char(param.getAttribute('name'));
        paramValue = char(param.getAttribute('value'));
        paramValue = evalin('base', paramValue);
        s.(paramName) = paramValue;
    end
end
```

Save `xml2struct` in the current folder.

Write a MATLAB function `MyFunc` that reads the XML file `MyParams.xml` into a structure `s` using the function `xml2struct`. Declare `xml2struct` as extrinsic using `coder.extrinsic` and call it in a `coder.const` statement.

```
function y = MyFunc(u) %#codegen
  assert(isa(u, 'double'));
  coder.extrinsic('xml2struct');
  s = coder.const(xml2struct('MyParams.xml'));
  y = s.hello + s.world + u;
```

Generate code for `MyFunc` using the `codegen` command. Open the Code Generation Report.

```
codegen -config:dll -launchreport MyFunc -args 0
```

The code generation software executes the call to `xml2struct` during code generation. It replaces the structure fields `s.hello` and `s.world` with the values 17 and 42 in generated code.

Input Arguments

`expression` — MATLAB expression or user-written function

expression with constants | single-output function with constant arguments

MATLAB expression or user-defined single-output function.

The expression must have compile-time constants only. The function must take constant arguments only. For instance, the following code leads to a code generation error, because `x` is not a compile-time constant.

```
function y=func(x)
   y=coder.const(log10(x));
```

To fix the error, assign `x` to a constant in the MATLAB code. Alternatively, during code generation, you can use `coder.Constant` to define input type as follows:

```
codegen -config:lib func -args coder.Constant(10)
```

Example: `2*pi`, `factorial(10)`

`handle` — Function handle

function handle

Handle to built-in or user-written function.

Example: `@log`, `@sin`

Data Types: `function_handle`

`arg1,...,argN` — Arguments to the function with handle `handle`

function arguments that are constants

Arguments to the function with handle `handle`.

The arguments must be compile-time constants. For instance, the following code leads to a code generation error, because `x` and `y` are not compile-time constants.

```
function y=func(x,y)
```

```
y=coder.const(@nchoosek,x,y);
```

To fix the error, assign `x` and `y` to constants in the MATLAB code. Alternatively, during code generation, you can use `coder.Constant` to define input type as follows:

```
codegen -config:lib func -args {coder.Constant(10),coder.Constant(2)}
```

Output Arguments

`out` — Value of `expression`

value of the evaluated expression

Value of `expression`. In the generated code, MATLAB Coder replaces occurrences of `out` with the value of `expression`.

`out1,...,outN` — Outputs of the function with handle `handle`

values of the outputs of the function with handle `handle`

Outputs of the function with handle `handle`.MATLAB Coder evaluates the function and replaces occurrences of `out1,...,outN` with constants in the generated code.

More About

Tips

- The code generation software constant-folds expressions automatically when possible. Typically, automatic constant-folding occurs for expressions with scalars only. Use `coder.const` when the code generation software does not constant-fold expressions on its own.
- “Constant Folding”

Introduced in R2013b

coder.cstructname

Package: coder

Name structure in generated code

Syntax

```
coder.cstructname(var,'structName')
coder.cstructname(var,'structName','extern')
coder.cstructname(var,'structName','extern',Name,Value)
newt = coder.cstructname(t,'structName')
newt = coder.cstructname(t,'structName','extern')
newt = coder.cstructname(t,'structName','extern',Name,Value)
```

Description

`coder.cstructname(var,'structName')` specifies the name of the structure type that represents `var` in the generated C/C++ code. `var` is a structure or cell array variable. `structName` is the name for the structure type in the generated code. Use this syntax in a function from which you generate code. Call `coder.cstructname` before the first use of the variable. If `var` is a cell array element, call `coder.cstructname` after the first assignment to the element.

`coder.cstructname(var,'structName','extern')` declares an externally defined structure. It does not generate the definition of the structure type. Provide the definition in a custom include file.

`coder.cstructname(var,'structName','extern',Name,Value)` uses additional options specified by one or more `Name,Value` pair arguments.

`newt = coder.cstructname(t,'structName')` returns a copy of the type object specified by `t`. The copy specifies the name `structName` to use for the structure type that represents `t` in the generated code. `t` is a `coder.StructType` object or a `coder.CellType` object. Use this syntax to create a type that you use with the `codegen -args` option. You cannot use this syntax in a function from which you generate code.

`newt = coder.cstructname(t,'structName','extern')` returns a `coder.type` that uses an externally defined structure. Provide the structure definition in a custom include file.

`newt = coder.cstructname(t,'structName','extern',Name,Value)` uses additional options specified by one or more `Name,Value` pair arguments.

Limitations

- You cannot use `coder.cstructname` with global variables.
- If `var` is a cell array or `t` is a `coder.CellType` object, the field names of externally defined structures must be `f1`, `f2`, and so on.
- If `var` is a cell array element, call `coder.cstructname` after the first assignment to the element. For example:

  ```
  ...
  x = cell(2,2);
  x{1} = struct('a', 3);
  coder.cstructname(x{1}, 'mytype');
  ...
  ```

Tips

- The code generation software represents a heterogeneous cell array as a structure in the generated C/C++ code. To specify the name of the generated structure type, use `coder.cstructname`.
- Using `coder.cstructname` with a homogeneous `coder.CellType` object `t` makes the returned object heterogeneous unless `t` is permanently homogeneous. If the `makeHomogeneous` method created `t` or if `t` is variable size,`t` is permanently homogeneous.
- When used with a `coder.CellType` object, `coder.cstructname` creates a `coder.CellType` object that is permanently heterogeneous.
- In a function from which you generate code, using `coder.cstructname` with a cell array variable makes the cell array heterogeneous. Unless the cell array type is permanently set to homogeneous, you can use `coder.cstructname` with an entry-point function input that is a cell array.

- To use `coder.cstructname` on arrays, use single indexing. For example, you cannot use `coder.cstructname(x(1,2))`. Instead, use single indexing, for example `coder.cstructname(x(n))`.
- If you use `coder.cstructname` on an array, it sets the name of the base type of the array, not the name of the array. Therefore, you cannot use `coder.cstructname` on the base element and then on the array. For example, the following code does not work. The second `coder.cstructname` attempts to set the name of the base type to `myStructArrayName`, which conflicts with the previous `coder.cstructname`, `myStructName`.

  ```
  % Define scalar structure with field a
  myStruct = struct('a', 0);
  coder.cstructname(myStruct,'myStructName');
  % Define array of structure with field a
  myStructArray = repmat(myStruct,k,n);
  coder.cstructname(myStructArray,'myStructArrayName');
  ```
- If you are using custom structure types, specify the name of the header file that includes the external definition of the structure. Use the `HeaderFile` input argument.
- If you have an Embedded Coder license and use Code Replacement Libraries (CRLs), the CRLs provide the ability to align data objects passed into a replacement function to a specified boundary. To take advantage of target-specific function implementations that require data to be aligned, use the `Alignment` input argument.
- You can also use `coder.cstructname` to assign a name to a substructure, which is a structure that appears as a field of another structure. For more information, see “Assign a Name to a SubStructure” on page 2-59.

Input Arguments

`structName`

The name of the structure type in the generated code.

`t`

`coder.StrucType` object or `coder.CellType` object.

`var`

Structure or cell array variable.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside single quotes (`' '`). You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

`'Alignment'`

The run-time memory alignment of structures of this type in bytes. If you have an Embedded Coder license and use Code Replacement Libraries (CRLs), the CRLs provide the ability to align data objects passed into a replacement function to a specified boundary. This capability allows you to take advantage of target-specific function implementations that require data to be aligned. By default, the structure is not aligned on a specific boundary. Hence it is not matched by CRL functions that require alignment.

`Alignment` must be either `-1` or a power of `2` that is not greater than `128`.

Default: -1

`'HeaderFile'`

Name of the header file that contains the external definition of the structure, for example, `'mystruct.h'`. Specify the path to the file. Use the `codegen -I` option or the **Additional include directories** parameter in the MATLAB Coder project settings dialog box **Custom Code** tab.

By default, the generated code contains `#include` statements for custom header files after the standard header files. If a standard header file refers to the custom structure type, then the compilation fails. By specifying the `HeaderFile` option, MATLAB Coder includes that header file exactly at the point where it is required.

Must be a non-empty string.

Output Arguments

`newt`

`coder.StrucType` object or `coder.CellType` object.

Examples

Apply `coder.cstructname` to Top-Level Inputs

Generate code for a MATLAB function that takes structure inputs.

1 Write a MATLAB function, `topfun`, that assigns the name `MyStruct` to its input parameter.

```
function y = topfun(x)   %#codegen
% Assign the name 'MyStruct' to the input variable in
% the generated code
  coder.cstructname(x, 'MyStruct');
  y = x;
end
```

2 Declare a structure `s` in MATLAB. `s` is the structure definition for the input variable `x`.

```
s = struct('a',42,'b',4711);
```

3 Generate a MEX function for `topfun`, using the `-args` option to specify that the input parameter is a structure.

```
codegen topfun.m -args { s }
```

`codegen` generates a MEX function in the default folder `codegen\mex\topfun`. In this folder, the structure definition is in `topfun_types.h`.

```
typedef struct
{
    double a;
    double b;
} MyStruct;
```

Assign a Name to a Structure and Pass It to a Function

Assign the name `MyStruct` to the structure `var`. Pass the structure to a C function `use_struct`.

1 Create a C header file, `use_struct.h`, for a `use_struct`function that takes a parameter of type `MyStruct`. Define a structure of type `MyStruct` in the header file.

```
#ifdef MATLAB_MEX_FILE
#include <tmwtypes.h>
```

```
#else
#include "rtwtypes.h"
#endif

typedef struct MyStruct
{
    double s1;
    double s2;
} MyStruct;

void use_struct(struct MyStruct *my_struct);
```

2 Write the C function `use_struct.c`.

```
#include <stdio.h>
#include <stdlib.h>

#include "use_struct.h"

void use_struct(struct MyStruct *my_struct)
{
  double x = my_struct->s1;
  double y = my_struct->s2;
}
```

3 Write a `m_use_struct` compliant with MATLAB that declares a structure. Have the function assign the name `MyStruct` to the structure. Then, have the function call the C function `use_struct` using `coder.ceval`.

```
function m_use_struct   %#codegen
% The directive %#codegen indicates that the function
% is intended for code generation
% Declare a MATLAB structure
var.s1 = 1;
var.s2 = 2;

% Assign the name MyStruct to the structure variable.
% extern indicates this is an externally defined
% structure.
coder.cstructname(var, 'MyStruct', 'extern');

% Call the C function use_struct. The type of var
% matches the signature of use_struct.
% Use coder.rref to pass the the variable var by
% reference as a read-only input to the external C
% function use_struct
coder.ceval('use_struct', coder.rref(var));
```

4. Generate C library code for function `m_use_struct`, passing `use_struct.h` to include the structure definition.

   ```
   codegen -config:lib m_use_struct use_struct.c use_struct.h
   ```
   `codegen` generates C code in the default folder `codegen\lib\m_use_struct`. The generated header file `m_use_struct_types.h` in this folder does not contain a definition of the structure `MyStruct` because `MyStruct` is an external type.

Assign a Name to a SubStructure

Use `coder.cstructname` to assign a name to a substructure.

1. Define a MATLAB structure, `top`, that has another structure, `lower`, as a field.

   ```
   % Define structure top with field lower,
   % which is a structure with fields a and b
   top.lower = struct('a',1,'b',1);
   top.c = 1;
   ```
2. Define a function, `MyFunc`, which takes an argument, `TopVar`, as input. Mark the function for code generation using `%#codegen`.

   ```
   function out = MyFunc(TopVar) %#codegen
   ```
3. Inside `MyFunc`, include the following lines

   ```
   coder.cstructname(TopVar,'topType');
   coder.cstructname(TopVar.lower,'lowerType');
   ```
4. So that `TopVar` has the same type as `top`, generate C code for `MyFunc` with an argument having the same type as `top`.

   ```
   codegen -config:lib MyFunc -args coder.typeof(top)
   ```

   In the generated C code, the field variable `TopVar.lower` is assigned the type name `lowerType`. For instance, the structure declaration of the variable `TopVar.lower` appears in the C code as:

   ```
   typedef struct
   {
       /* Definitions of a and b appear here */
   } lowerType;
   ```

   and the structure declaration of the variable `TopVar` appears as:

```
typedef struct
{
     lowerType lower;
    /* Definition of c appears here */
} topType;
```

Create a coder.type Object

Create a `coder.type` object and pass it as `codegen` argument.

```
S = struct('a',double(0),'b',single(0))
T = coder.typeof(S);
T = coder.cstructname(T,'mytype');
codegen -config:lib MyFile -args T
```

In this example, you create a `coder.type` object `T`. The object is passed as a `codegen` argument. However, because of the `coder.cstructname` statement, `T` is replaced with `mytype` in the generated C code. For instance, the declaration of `T` appears in the C code as:

```
typedef struct
{
    /* Field definitions appear here */
} mytype;
```

Create a coder.type Object Using an Externally Defined Type

Create a C header file, `MyFile.h`, containing the definition of a structure type, `mytype`.

```
typedef struct {
    /* Field definitions */
    double a;
    float b;
   } mytype;
```

Save the file in the folder, `C:\MyHeaders`.

Define a `coder.type` object, `T`, with the same fields as `mytype`.

```
T = coder.typeof(struct('a',double(0),'b',single(0)));
```

Using `coder.cstructname`, rename `T` as `mytype`. Specify that the definition of `mytype` is in `MyFile.h`.

```
T = coder.cstructname(T,'mytype','extern','HeaderFile','MyFile.h');
```

Generate code for MATLAB function, `MyFunc`, which takes a structure of type, `T`, as input argument. Add the folder, `C:\MyHeaders`, to the include path during code generation.

```
codegen -config:lib MyFunc -args T -I C:\MyHeaders
```

In the generated code, the structure, `T`, is assigned the name, `mytype`. The code generation software does not generate the definition of `mytype`. Instead the software includes the header file, `MyFile.h`, in the generated code.

Assign a Structure Type Name to a `coder.CellType` Object

Create a `coder.CellType` object for a cell array whose first element is char and whose second element is double.

```
T = coder.typeof({'c', 1})
```

```
T =

coder.CellType
   1x2 heterogeneous cell
      f0: 1x1 char
      f1: 1x1 double
```

`T` is a heterogeneous `coder.CellType` object.

Create a copy of `T` that specifies the name `myname` for the structure type that represents `T` in the generated code.

```
T = coder.cstructname(T, 'myname')
```

```
coder.CellType
   1x2 heterogeneous cell myname
      f0: 1x1 char
      f1: 1x1 double
```

Assign a Name to a Structure That Is an Element of a Cell Array

Write a function `struct_in_cell` that has a cell array `x{1}` that contains a structure. The `coder.cstructname` call follows the assignment to `x{1}`.

```
function z = struct_in_cell()
```

```
x = cell(2,2);
x{1} = struct('a', 3);
coder.cstructname(x{1}, 'mytype');
z = x{1};
end
```

Generate a static library for `struct_in_cell`.

```
codegen -config:lib struct_in_cell -report
```

The type for `a` has the name `mytype`.

```
 typedef struct {
  double a;
} mytype;
```

- "Structures"
- "Cell Arrays"

More About

- "Homogeneous vs. Heterogeneous Cell Arrays"

See Also

coder.StructType | coder.CellType | `codegen` | `coder.ceval` | `coder.rref`

Introduced in R2011a

coder.extrinsic

Package: coder

Declare extrinsic function or functions

Syntax

```
coder.extrinsic('function_name');

coder.extrinsic('function_name_1', ... , 'function_name_n');

coder.extrinsic('-sync:on', 'function_name');

coder.extrinsic('-sync:on', 'function_name_1', ... ,
'function_name_n');

coder.extrinsic('-sync:off','function_name');

coder.extrinsic('-sync:off', 'function_name_1', ... ,
'function_name_n');
```

Arguments

`function_name`
`function_name_1`, ... , *`function_name_n`*

Declares *`function_name`* or *`function_name_1`* through *`function_name_n`* as extrinsic functions.

`–sync:on`

`function_name` or *`function_name_1`* through *`function_name_n`*.

Enables synchronization of global data between MATLAB and MEX functions before and after calls to the extrinsic functions, *`function_name`* or *`function_name_1`* through *`function_name_n`*. If only a few extrinsic calls modify global data, turn off synchronization before and after all extrinsic function calls by setting the global synchronization mode to `At MEX-function entry and exit`. Use the *–sync:on* option to turn on synchronization for only the extrinsic calls that *do* modify global data.

For constant global data, enables verification of consistency between MATLAB and MEX functions after calls to the extrinsic functions, `function_name` or `function_name_1` through `function_name_n`.

`–sync:off`

Disables synchronization of global data between MATLAB and MEX functions before and after calls to the extrinsic functions, `function_name` or `function_name_1` through `function_name_n`. If most extrinsic calls modify global data, but a few do not, you can use the *–sync:off* option to turn off synchronization for the extrinsic calls that *do not* modify global data.

For constant global data, disables verification of consistency between MATLAB and MEX functions after calls to the extrinsic functions, `function_name` or `function_name_1` through `function_name_n`.

Description

`coder.extrinsic` declares extrinsic functions. During simulation, the code generation software generates code for the call to an extrinsic function, but does not generate the function's internal code. Therefore, simulation can run only on platforms where MATLAB software is installed. During standalone code generation, MATLAB attempts to determine whether the extrinsic function affects the output of the function in which it is called — for example by returning `mxArrays` to an output variable. Provided that there is no change to the output, MATLAB proceeds with code generation, but excludes the extrinsic function from the generated code. Otherwise, compilation errors occur.

You cannot use `coder.ceval` on functions that you declare extrinsic by using `coder.extrinsic`.

`coder.extrinsic` is ignored outside of code generation.

Tips

- The code generation software detects calls to many common visualization functions, such as `plot`, `disp`, and `figure`. The software treats these functions like extrinsic functions, but you do not have to declare them extrinsic using the `coder.extrinsic` function.

- Use the `coder.screener` function to detect which functions you must declare extrinsic. This function opens the code generations readiness tool that detects code generation issues in your MATLAB code.

  During code generation, MATLAB attempts to determine whether the extrinsic function affects the output of the function in which it is called—for example, by returning `mxArrays` to an output variable. Provided that there is no change to the output, MATLAB proceeds with code generation, but excludes the extrinsic function from the generated code. Otherwise, a MATLAB issues a compiler error.

Examples

The following code declares the MATLAB functions `patch` and `axis` extrinsic in the MATLAB local function `create_plot`:

```
function c = pythagoras(a,b,color) %#codegen
% Calculates the hypotenuse of a right triangle
%  and displays the triangle as a patch object.

c = sqrt(a^2 + b^2);

create_plot(a, b, color);

function create_plot(a, b, color)
%Declare patch and axis as extrinsic

coder.extrinsic('patch', 'axis');

x = [0;a;a];
y = [0;0;b];
patch(x, y, color);
axis('equal');
```

By declaring these functions extrinsic, you instruct the software not to compile or generate code for `patch` and `axis`. Instead it dispatches these functions to MATLAB for execution.

More About

- “Call MATLAB Functions”

- “Controlling Synchronization for Extrinsic Function Calls”
- “Define Constant Global Data”
- “Resolution of Function Calls for Code Generation”
- “Restrictions on Extrinsic Functions for Code Generation”

See Also

`coder.screener` | `coder.ceval`

Introduced in R2011a

coder.getArgTypes

Determine types of function input arguments by running test file

Syntax

```
types = coder.getArgTypes(test_fcn,fcn)
structure_of_types = coder.getArgTypes(test_fcn, {fcn_1,...,fcn_n})
structure_of_types = coder.getArgTypes(test_fcn,fcn,'uniform',true)
```

Description

`types = coder.getArgTypes(test_fcn,fcn)` returns a cell array of `coder.Type` objects determined by executing `test_fcn`. `test_fcn` should call the specified entry-point MATLAB function, `fcn`. The software uses the input arguments to `fcn` to construct the returned types.

`structure_of_types = coder.getArgTypes(test_fcn, {fcn_1,...,fcn_n})` returns a structure containing cell arrays of `coder.Type` objects determined by executing `test_fcn`. `test_fcn` should call the specified entry-point functions, `fcn_1` through `fcn_n`. The software uses the input arguments to these functions to construct the returned types. The returned structure contains one field for each function. The field name is the same as the name of the corresponding function.

`structure_of_types = coder.getArgTypes(test_fcn,fcn,'uniform',true)` returns a structure even though there is only one entry-point function.

Input Arguments

`fcn`

Name or handle of entry-point MATLAB function for which you want to determine input types. The function must be on the MATLAB path; it cannot be a local function. The function must be in a writable folder.

`fcn_1,...,fcn_n`

Comma-separated list of names or handles of entry-point MATLAB functions for which you want to determine input types. The functions must be on the MATLAB path; they cannot be a local function. The functions must be in a writable folder. The entry-point function names must be unique.

`test_fcn`

Name or handle of test function or name of test script. The test function or script must be on the MATLAB path. `test_fcn` should call at least one of the specified entry-point functions. The software uses the input arguments to these functions to construct the returned types.

Output Arguments

`types`

Cell array of `coder.Type` objects determined by executing the test function.

`structure_of_types`

Structure containing cell arrays of `coder.Type` objects determined by executing the `test_fcn`. The structure contains one field for each function. The field name is the same as the name of the corresponding function.

Examples

Get input parameter types for one entry-point function

Get input parameter types for function `my_fun` by running test file `my_test` that calls `my_fun`. Use these input types to generate code for `my_fun`.

In a local writable folder, create the MATLAB function.

```
function y = my_fun(u,v) %#codegen
 y = u+v;
end
```

In the same folder, create the test function.

```
function y = my_test
 a = single(10);
  b = single(20);
 y = my_fun(a,b);
end
```

Run the test function to get the input types for `my_fun`.

```
types=coder.getArgTypes('my_test','my_fun')
```

```
types = 

    [1x1 coder.PrimitiveType]    [1x1 coder.PrimitiveType]
```

Generate a MEX function for `my_fun` using these input types as example inputs.

```
codegen my_fun -args types
```

In the current folder, `codegen` generates a MEX function, `my_fun_mex`, that accepts inputs of type `single`.

You can now test the MEX function. For example:

```
 y = my_fun_mex(single(11),single(22))
```

Get input types for multiple entry-point functions

Get input parameter types for functions `my_fun1` and `my_fun2` by running test file `my_test2` that calls `my_fun1` and `my_fun2`. Use these input types to generate code for `my_fun1` and `my_fun2`.

In a local writable folder, create the MATLAB function, `my_fun1`.

```
function y = my_fun1(u) %#codegen
y = u;
```

In the same folder, create the function, `my_fun2`.

```
function y = my_fun2(u, v) %#codegen
y = u + v;
```

In the same folder, create the test function.

```
function [y1, y2] =  my_test2
 a=10;
 b=20;
 y1=my_fun1(a);
 y2=my_fun2(a,b);
end
```

Run the test function to get the input types for `my_fun1` and `my_fun2`.

```
types=coder.getArgTypes('my_test2',{'my_fun1','my_fun2'})
```

```
types = 

    my_fun1: {[1x1 coder.PrimitiveType]}
    my_fun2: {[1x1 coder.PrimitiveType]  [1x1 coder.PrimitiveType]}
```

Generate a MEX function for `my_fun1` and `my_fun2` using these input types as example inputs.

```
codegen my_fun1 -args types.my_fun1 my_fun2 -args types.my_fun2
```

In the current folder, `codegen` generates a MEX function, `my_fun1_mex`, with two entry points, `my_fun1` and `my_fun2`, that accept inputs of type `double`.

You can now test each entry point in the MEX function. For example:

```
y1=my_fun1_mex('my_fun1',10)
y2=my_fun1_mex('my_fun2',15, 25)
```

Alternatives

- “Specify Properties of Entry-Point Function Inputs Using the App”
- “Define Input Properties Programmatically in the MATLAB File”

More About

Tips

- Before using `coder.getArgTypes`, run the test function in MATLAB to verify that it provides the expected results.
- Verify that the test function calls the specified entry-point functions with input data types suitable for your runtime environment. If the test function does not call a

specified function, `coder.getArgTypes` cannot determine the input types for this function.

- `coder.getArgTypes` might not compute the ideal type for your application. For example, you might want the size to be unbounded. `coder.getArgTypes` returns a bound based on the largest input that it has seen. Use `coder.resize` to adjust the sizes of the returned types.
- For some combinations of inputs, `coder.getArgTypes` cannot produce a valid type. For example, if the test function calls the entry-point function with single inputs and then calls it with double inputs, `coder.getArgTypes` generates an error because there is no single type that can represent both calls.
- When you generate code for the MATLAB function, use the returned types as example inputs by passing them to the `codegen` using the `-args` option.

- “Primary Function Input Specification”

See Also

`codegen` | `coder.resize` | `coder.runTest` | `coder.typeof`

coder.inline

Package: coder

Control inlining in generated code

Syntax

```
coder.inline('always')
coder.inline('never')
coder.inline('default')
```

Description

`coder.inline('always')` forces inlining of the current function in generated code.

`coder.inline('never')` prevents inlining of the current function in generated code. For example, you may want to prevent inlining to simplify the mapping between the MATLAB source code and the generated code.

`coder.inline('default')` uses internal heuristics to determine whether or not to inline the current function.

In most cases, the heuristics used produce highly optimized code. Use `coder.inline` only when you need to fine-tune these optimizations.

Place the `coder.inline` directive inside the function to which it applies. The code generation software does not inline entry-point functions.

`coder.inline('always')` does not inline functions called from `parfor`-loops. The code generation software does not inline functions into `parfor`-loops.

Examples

- "Preventing Function Inlining" on page 2-73
- "Using coder.inline In Control Flow Statements" on page 2-73

Preventing Function Inlining

In this example, function `foo` is not inlined in the generated code:

```
function y = foo(x)
  coder.inline('never');
  y = x;
end
```

Using coder.inline In Control Flow Statements

You can use `coder.inline` in control flow code. If the software detects contradictory `coder.inline` directives, the generated code uses the default inlining heuristic and issues a warning.

Suppose you want to generate code for a division function that will be embedded in a system with limited memory. To optimize memory use in the generated code, the following function, `inline_division`, manually controls inlining based on whether it performs scalar division or vector division:

```
function y = inline_division(dividend, divisor)

% For scalar division, inlining produces smaller code
% than the function call itself.
if isscalar(dividend) && isscalar(divisor)
   coder.inline('always');
else
% Vector division produces a for-loop.
% Prohibit inlining to reduce code size.
   coder.inline('never');
end

if any(divisor == 0)
   error('Can not divide by 0');
end

y = dividend / divisor;
```

Introduced in R2011a

coder.load

Load compile-time constants from MAT-file or ASCII file into caller workspace

Syntax

```
S = coder.load(filename)
S = coder.load(filename,var1,...,varN)
S = coder.load(filename,'-regexp',expr1,...,exprN)
S = coder.load(filename,'-ascii')
S = coder.load(filename,'-mat')
S = coder.load(filename,'-mat',var1,...,varN)
S = coder.load(filename,'-mat','-regexp', expr1,...,exprN)
```

Description

`S = coder.load(filename)` loads compile-time constants from `filename`.

- If `filename` is a MAT-file, then `coder.load` loads variables from the MAT-file into a structure array.
- If `filename` is an ASCII file, then `coder.load` loads data into a double-precision array.

`S = coder.load(filename,var1,...,varN)` loads only the specified variables from the MAT-file `filename`.

`S = coder.load(filename,'-regexp',expr1,...,exprN)` loads only the variables that match the specified regular expressions.

`S = coder.load(filename,'-ascii')` treats `filename` as an ASCII file, regardless of the file extension.

`S = coder.load(filename,'-mat')` treats `filename` as a MAT-file, regardless of the file extension.

`S = coder.load(filename,'-mat',var1,...,varN)` treats `filename` as a MAT-file and loads only the specified variables from the file.

`S = coder.load(filename,'-mat','-regexp', expr1,...,exprN)` treats `filename` as a MAT-file and loads only the variables that match the specified regular expressions.

Examples

Load compile-time constants from MAT-file

Generate code for a function `edgeDetect1` which given a normalized image, returns an image where the edges are detected with respect to the threshold value. `edgeDetect1` uses `coder.load` to load the edge detection kernel from a MAT-file at compile time.

Save the Sobel edge-detection kernel in a MAT-file.

```
k = [1 2 1; 0 0 0; -1 -2 -1];
```

```
save sobel.mat k
```

Write the function `edgeDetect1`.

```
function edgeImage = edgeDetect1(originalImage, threshold) %#codegen
assert(all(size(originalImage) <= [1024 1024]));
assert(isa(originalImage, 'double'));
assert(isa(threshold, 'double'));

S = coder.load('sobel.mat','k');
H = conv2(double(originalImage),S.k, 'same');
V = conv2(double(originalImage),S.k','same');
E = sqrt(H.*H + V.*V);
edgeImage = uint8((E > threshold) * 255);
```

Create a code generation configuration object for a static library.

```
cfg = coder.config('lib');
```

Generate a static library for `edgeDetect1`.

```
codegen -report -config cfg edgeDetect1
```

`codegen` generates C code in the `codegen\lib\edgeDetect1` folder.

Load compile-time constants from ASCII file

Generate code for a function `edgeDetect2` which given a normalized image, returns an image where the edges are detected with respect to the threshold value. `edgeDetect2` uses `coder.load` to load the edge detection kernel from an ASCII file at compile time.

Save the Sobel edge-detection kernel in an ASCII file.

```
k = [1 2 1; 0 0 0; -1 -2 -1];
save sobel.dat k -ascii
```

Write the function `edgeDetect2`.

```
function edgeImage = edgeDetect2(originalImage, threshold) %#codegen
assert(all(size(originalImage) <= [1024 1024]));
assert(isa(originalImage, 'double'));
assert(isa(threshold, 'double'));

k = coder.load('sobel.dat');
H = conv2(double(originalImage),k, 'same');
V = conv2(double(originalImage),k','same');
E = sqrt(H.*H + V.*V);
edgeImage = uint8((E > threshold) * 255);
```

Create a code generation configuration object for a static library.

```
cfg = coder.config('lib');
```

Generate a static library for `edgeDetect2`.

```
codegen -report -config cfg edgeDetect2
```

`codegen` generates C code in the `codegen\lib\edgeDetect2` folder.

Input Arguments

`filename` — Name of file

string

Name of file, specified as a string constant.

`filename` can include a file extension and a full or partial path. If `filename` has no extension, `load` looks for a file named `filename.mat`. If `filename` has an extension other than `.mat`, `load` treats the file as ASCII data.

ASCII files must contain a rectangular table of numbers, with an equal number of elements in each row. The file delimiter (the character between elements in each row) can be a blank, comma, semicolon, or tab character. The file can contain MATLAB comments (lines that begin with a percent sign, `%`).

Example: `'myFile.mat'`

Data Types: `char`

`var1,...,varN` — Names of variables to load
string

Names of variables, specified as string constants. Use the `*` wildcard to match patterns.

Example: `load('myFile.mat','A*')` loads all variables in the file whose names start with `A`.

Data Types: `char`

`expr1,...,exprN` — Regular expressions indicating which variables to load
string

Regular expressions indicating which variables to load, specified as string constants.

Example: `load('myFile.mat', '^A', '^B')` loads only variables whose names begin with `A` or `B`.

Data Types: `char`

Output Arguments

`S` — Loaded variables or data
structure array | m-by-n array

If `filename` is a MAT-file, `S` is a structure array.

If `filename` is an ASCII file, `S` is an m-by-n array of type `double`. m is the number of lines in the file and n is the number of values on a line.

Limitations

- `coder.load` does not support loading objects.
- Arguments to `coder.load` must be compile-time constant strings.
- The output `S` must be the name of a structure or array without any subscripting. For example, `S(i) = coder.load('myFile.mat')` is not allowed.
- You cannot use `save` to save workspace data to a file inside a function intended for code generation. The code generation software does not support the `save` function. Furthermore, you cannot use `coder.extrinsic` with `save`. Prior to generating code, you can use `save` to save workspace data to a file.

More About

Tips

- `coder.load` loads data at compile time, not at run time. If you are generating MEX code or code for Simulink® simulation, you can use the MATLAB function `load` to load run-time values.
- If the MAT-file contains unsupported constructs, use `coder.load(filename,var1,...,varN)` to load only the supported constructs.
- If you generate code in a MATLAB Coder project, the code generation software practices incremental code generation for the `coder.load` function. When the MAT-file or ASCII file used by `coder.load` changes, the software rebuilds the code.

- “Regular Expressions”

See Also

`matfile` | `regexp` | `save`

Introduced in R2013a

coder.newtype

Package: coder

Create a `coder.Type` object

Syntax

```
t = coder.newtype(numeric_class, sz, variable_dims)
t = coder.newtype(numeric_class, sz, variable_dims, Name, Value)
t = coder.newtype('constant', value)
t = coder.newtype('struct', struct_fields, sz, variable_dims)
t = coder.newtype('cell', cells, sz, variable_dims)
t = coder.newtype('embedded.fi', numerictype, sz, variable_dims,
Name, Value)
t = coder.newtype(enum_value, sz, variable_dims)
```

Description

Note: `coder.newtype` is an advanced function that you can use to control the `coder.Type` object. Consider using `coder.typeof` instead. `coder.typeof` creates a type from a MATLAB example.

`t = coder.newtype(numeric_class, sz, variable_dims)` creates a `coder.Type` object representing values of class `numeric_class` with (upper bound) sizes `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is unbounded and the dimension is variable size. When `variable_dims` is not specified, the dimensions of the type are fixed except for those that are unbounded. When `variable_dims` is a scalar, it is applied to dimensions of the type that are not `1` or `0`, which are fixed.

`t = coder.newtype(numeric_class, sz, variable_dims, Name, Value)` creates a `coder.Type` object with additional options specified by one or more Name, Value pair arguments.

`t = coder.newtype('constant', value)` creates a `coder.Constant` object representing a single value. Use this type to specify a value that must be treated as a constant in the generated code.

`t = coder.newtype('struct', struct_fields, sz, variable_dims)` creates a `coder.StructType` object for an array of structures that has the same fields as the scalar structure `struct_fields`. The structure array type has the size specified by `sz` and variable-size dimensions specified by `variable_dims`.

`t = coder.newtype('cell', cells, sz, variable_dims)` creates a `coder.CellType` object for a cell array that has the cells and cell types specified by `cells`. The cell array type has the size specified by `sz` and variable-size dimensions specified by `variable_dims`. You cannot change the number of cells or specify variable-size dimensions for a heterogeneous cell array.

`t = coder.newtype('embedded.fi', numerictype, sz, variable_dims, Name, Value)` creates a `coder.FiType` object representing a set of fixed-point values with `numerictype` and additional options specified by one or more Name, Value pair arguments.

`t = coder.newtype(enum_value, sz, variable_dims)` creates a `coder.Type` object representing a set of enumeration values of class `enum_value`.

Input Arguments

`numeric_class`

Class of the set of values represented by the type object

`struct_fields`

Scalar structure used to specify the fields in a new structure type

`cells`

Cell array of `coder.Type` objects that specify the types of the cells in a new cell array type.

`sz`

Size vector specifying each dimension of type object. `sz` cannot change the number of cells for a heterogeneous cell array.

Default: `[1 1]`

`variable_dims`

Logical vector that specifies whether each dimension is variable size (true) or fixed size (false). You cannot specify variable-size dimensions for a heterogeneous cell array.

Default: `true` for dimensions for which `sz` specifies an upper bound of `inf`; `false` for all other dimensions.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside single quotes (`' '`). You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

`'complex'`

Set `complex` to `true` to create a `coder.Type` object that can represent complex values. The type must support complex data.

Default: false

`'fimath'`

Specify local `fimath`. If `fimath` is not specified, uses default fimath values.

Use only with `t`=coder.newtype('embedded.fi', numerictype,`sz`, `variable_dims`, Name, Value).

`'sparse'`

Set `sparse` to `true` to create a `coder.Type` object representing sparse data. The type must support sparse data.

Not for use with `t`=coder.newtype('embedded.fi', numerictype,`sz`, `variable_dims`, Name, Value)

Default: false

Output Arguments

`t`

New `coder.Type` object.

Examples

Create a type for use in code generation.

```
t=coder.newtype('double',[2 3 4],[1 1 0])
% Returns double :2x:3x4
% ':' indicates variable-size dimensions
```

Create a type for a matrix of doubles, first dimension unbounded, second dimension with fixed size

```
coder.newtype('double',[inf,3])
%   returns double:inf x 3

coder.newtype('double', [inf, 3], [1 0])
%   also returns double :inf x3
%   ':' indicates variable-size dimensions
```

Create a type for a matrix of doubles, first dimension unbounded, second dimension with variable size with an upper bound of `3`

```
coder.newtype('double', [inf,3],[0 1])
%  returns double :inf x :3
%  ':' indicates variable-size dimensions
```

Create a structure type to use in code generation.

```
ta = coder.newtype('int8',[1 1]);
tb = coder.newtype('double',[1 2],[1 1]);
coder.newtype('struct',struct('a',ta,'b',tb))
% returns struct 1x1
%           a: int8 1x1
%           b: double :1x:2
% ':' indicates variable-size dimensions
```

Create a cell array to use in code generation.

```
ta = coder.newtype('int8',[1 1]);
tb = coder.newtype('double',[1 2],[1 1]);
coder.newtype('cell',{ta, tb})
% returns 1x2 heterogeneous cell
%            f0: 1x1 int8
%            f1: :1x:2 double
% ':' indicates variable-size dimensions
```

Create a new constant type to use in code generation.

```
k = coder.newtype('constant', 42);
% Returns
% k =
%
% coder.Constant
%       42
```

Create a `coder.EnumType` object using the name of an existing MATLAB enumeration.

1 Define an enumeration `MyColors`. On the MATLAB path, create a file named 'MyColors' containing:

   ```
   classdef MyColors < int32
       enumeration
           green(1),
           red(2),
       end
   end
   ```

2 Create a `coder.EnumType` object from this enumeration.

   ```
   t = coder.newtype('MyColors');
   ```

Create a new fixed-point type for use in code generation. The fixed-point type uses default fimath values.

```
t = coder.newtype('embedded.fi',...
   numerictype(1, 16, 15), [1 2])

t =
% Returns
% coder.FiType
%   1x2 embedded.fi
%     DataTypeMode: Fixed-point: binary point scaling
%     Signedness: Signed
%     WordLength: 16
```

```
%     FractionLength: 15
```

Alternatives

`coder.typeof`

See Also

coder.Type | coder.ArrayType | coder.EnumType | coder.FiType | coder.PrimitiveType | coder.StructType | coder.CellType | `codegen` | `coder.resize`

Introduced in R2011a

coder.nullcopy

Package: coder

Declare uninitialized variables

Syntax

`X = coder.nullcopy(A)`

Description

`X = coder.nullcopy(A)` copies type, size, and complexity of *A* to *X*, but does not copy element values. Preallocates memory for *X* without incurring the overhead of initializing memory.

`coder.nullcopy` does not support MATLAB classes as inputs.

Use With Caution

Use this function with caution. See “How to Eliminate Redundant Copies by Defining Uninitialized Variables”.

Examples

The following example shows how to declare variable *X* as a 1-by-5 vector of real doubles without performing an unnecessary initialization:

```
function X = foo

N = 5;
X = coder.nullcopy(zeros(1,N));
for i = 1:N
   if mod(i,2) == 0
      X(i) = i;
   else
```

```
        X(i) = 0;
    end
end
```

Using `coder.nullcopy` with `zeros` lets you specify the size of vector *X* without initializing each element to zero.

More About

- "Eliminate Redundant Copies of Variables in Generated Code"

Introduced in R2011a

coder.opaque

Declare variable in generated code

Syntax

```
y = coder.opaque(type)
y = coder.opaque(type,value)
y = coder.opaque(type,'HeaderFile',HeaderFile)
y = coder.opaque(type,value,'HeaderFile',HeaderFile)
```

Description

`y = coder.opaque(type)` declares a variable `y` with the specified type and no initial value in the generated code.

- `y` can be a variable or a structure field.
- MATLAB code cannot set or access `y`, but external C functions can accept `y` as an argument.
- `y` can be an:
  - Argument to `coder.rref`, `coder.wref`, or `coder.ref`
  - Input or output argument to `coder.ceval`
  - Input or output argument to a user-written MATLAB function
  - Input to a subset of MATLAB toolbox functions supported for code generation
- Assignment from `y` declares another variable with the same type in the generated code. For example:

  ```
  y = coder.opaque('int');
  z = y;
  ```
  declares a variable `z` of type `int` in the generated code.
- You can assign `y` from another variable declared using either `coder.opaque` or assignment from a variable declared using `coder.opaque`. The variables must have identical types.

- You can compare `y` to another variable declared using either `coder.opaque` or assignment from a variable declared using `coder.opaque`. The variables must have identical types.

`y = coder.opaque(type,value)` declares a variable `y` and specifies the initial value of `y` in the generated code.

`y = coder.opaque(type,'HeaderFile',HeaderFile)` declares a variable `y` and specifies the header file that contains the definition of `type`. The code generation software generates the `#include` statement for the header file where required in the generated code.

`y = coder.opaque(type,value,'HeaderFile',HeaderFile)` declares a variable `y` with the specified type, initial value, and header file in the generated code.

Examples

Declare Variable Specifying Initial Value

Generate code for a function `valtest` which returns `1` if the call to `myfun` is successful. This function uses `coder.opaque` to declare a variable `x1` with type `int` and initial value `0`. The assignment `x2 = x1` declares `x2` to be a variable with the type and initial value of `x1` .

Write a function `valtest`.

```
function y = valtest
%codegen
%declare x1 to be an integer with initial value '0')
x1 = coder.opaque('int','0');
%Declare x2 to have same type and intial value as x1
x2 = x1;
x2 = coder.ceval('myfun');
%test the result of call to 'myfun' by comparing to value of x1
if x2 == x1;
  y = 0;
else
  y = 1;
end
end
```

Create a code generation configuration object for a static library.

```
cfg = coder.config('lib');
```

Generate a static library for `valtest`.

```
codegen -report -config cfg valtest
```

`codegen` generates C code in the `codegen\lib\valtest` folder.

Declare Variable Specifying Initial Value and Header File

Generate code for a MATLAB function `filetest` which returns its own source code using `fopen/fread/fclose`. This function uses `coder.opaque` to declare the variable that stores the file pointer used by `fopen/fread/fclose`. The call to `coder.opaque` declares the variable `f` with type `FILE *`, initial value `NULL`, and header file `<stdio.h>`.

Write a MATLAB function `filetest`.

```
function buffer = filetest
%#codegen

% Declare 'f' as an opaque type 'FILE *' with intial value 'NULL"
%Specify the header file that contains the type definition of 'FILE *';

f = coder.opaque('FILE *', 'NULL','HeaderFile','<stdio.h>');
% Open file in binary mode
f = coder.ceval('fopen', cstring('filetest.m'), cstring('rb'));

% Read from file until end of file is reached and put
% contents into buffer
n = int32(1);
i = int32(1);
buffer = char(zeros(1,8192));
while n > 0
    % By default, MATLAB converts constant values
    % to doubles in generated code
    % so explicit type conversion to int32 is inserted.
    n = coder.ceval('fread', coder.ref(buffer(i)), int32(1), ...
        int32(numel(buffer)), f);
    i = i + n;
end
coder.ceval('fclose',f);

buffer = strip_cr(buffer);

% Put a C termination character '\0' at the end of MATLAB string
function y = cstring(x)
    y = [x char(0)];
```

```
% Remove all character 13 (CR) but keep character 10 (LF)
function buffer = strip_cr(buffer)
j = 1;
for i = 1:numel(buffer)
    if buffer(i) ~= char(13)
        buffer(j) = buffer(i);
        j = j + 1;
    end
end
buffer(i) = 0;
```

Create a code generation configuration object for a static library.

```
cfg = coder.config('lib');
```

Generate a static library for `filetest`.

```
codegen -report -config cfg filetest
```

`codegen` generates C code in the `codegen\lib\filetest` folder.

Compare Variables Declared Using `coder.opaque`

Compare variables declared using `coder.opaque` to test for successfully opening a file.

Use `coder.opaque` to declare a variable `null` with type `FILE *` and initial value `NULL`.

```
null = coder.opaque('FILE *', 'NULL', 'HeaderFile', '<stdio.h>');
```

Use assignment to declare another variable `ftmp` with the same type and value as `null`.

```
ftmp = null;
ftmp = coder.ceval('fopen', ['testfile.txt', char(0)], ['r', char(0)]);
```

Compare the variables.

```
if ftmp == null
  %error condition
end
```

Cast to and from Types of Variables Declared Using `coder.opaque`

This example shows how to cast to and from types of variables that are declared using `coder.opaque`. The function `castopaque` calls the C run-time function `strncmp` to compare at most `n` characters of the strings `s1` and `s2`. `n` is the number of characters in the shorter of the strings. To generate the correct C type for the `strncmp` input `nsizet`, the function casts `n` to the C type `size_t` and assigns the result to `nsizet`. The function uses `coder.opaque` to declare `nsizet`. Before using the output `retval` from `strncmp`, the function casts `retval` to the MATLAB type `int32` and stores the results in `y`.

Write this MATLAB function:

```
function y = castopaque(s1,s2)

%  <0 - the first character that does not match has a lower value in s1 than in s2
%   0 - the contents of both strings are equal
%  >0 - the first character that does not match has a greater value in s1 than in s2
%
%#codegen

coder.cinclude('<string.h>');
n = min(numel(s1), numel(s2));

% Convert the number of characters to compare to a size_t

nsizet = cast(n,'like',coder.opaque('size_t','0'));

% The return value is an int
retval = coder.opaque('int');
retval = coder.ceval('strncmp', cstr(s1), cstr(s2), nsizet);

% Convert the opaque return value to a MATLAB value
y = cast(retval, 'int32');

%--------------
function sc = cstr(s)
% NULL terminate a MATLAB string for C
sc = [s, char(0)];
```

Generate the MEX function.

```
codegen castopaque -args {blanks(3), blanks(3)} -report
```

Call the MEX function with inputs `'abc'` and `'abc'`.

```
castopaque_mex('abc','abc')

ans =
           0
```

The output is `0` because the strings are equal.

Call the MEX function with inputs `'abc'` and `'abd'`.

```
castopaque_mex('abc','abd')
```

```
ans =

          -1
```

The output is `-1` because the third character `d` in the second string is greater than the third character `c` in the first string.

Call the MEX function with inputs `'abd'` and `'abc'`.

```
castopaque_mex('abd','abc')
```

```
ans =

           1
```

The output is `1` because the third character `d` in the first string is greater than the third character `c` in the second string.

In the MATLAB workspace, you can see that the type of `y` is `int32`.

Input Arguments

`type` — Type of variable

string

Type of variable in generated code specified as a string constant. The type must be a:

- Built-in C data type or a type defined in a header file
- C type that supports copy by assignment
- Legal prefix in a C declaration

Example: `'FILE *'`

Data Types: `char`

`value` — Initial value of variable
string

Initial value of variable in generated code specified as a string constant. Specify a C expression not dependent on MATLAB variables or functions.

If you do not provide the initial value in `value`, initialize the value of the variable prior to using it. To initialize a variable declared using `coder.opaque`:

- Assign a value from another variable with the same type declared using either `coder.opaque` or assignment from a variable declared using `coder.opaque`.
- Assign a value from an external C function.
- Pass the variable's address to an external function using `coder.wref`.

Specify a `value` that has the type that `type` specifies. Otherwise, the generated code can produce unexpected results.

Example: `'NULL'`

Data Types: `char`

`HeaderFile` — Name of header file
string

Name of header file, specified as a string constant, that contains the definition of `type`.

For a system header file, use angle brackets.

Example: `'<stdio.h>'` generates `#include <stdio.h>`

For an application header file, use double quotes.

Example: `'"foo.h"'` generates `#include "foo.h"`

If you omit the angle brackets or double quotes, the code generation software generates double quotes.

Example: `'foo.h'` generates `#include "foo.h"`

Specify the include path in the build configuration parameters.

Example: `cfg.CustomInclude = 'c:\myincludes'`

Data Types: `char`

More About

Tips

- Specify a `value` that has the type that `type` specifies. Otherwise, the generated code can produce unexpected results. For example, the following `coder.opaque` declaration can produce unexpected results.

  ```
  y = coder.opaque('int', '0.2')
  ```

- `coder.opaque` declares the type of a variable. It does not instantiate the variable. You can instantiate a variable by using it later in the MATLAB code. In the following example, assignment of `fp1` from `coder.ceval` instantiates `fp1`.

  ```
  % Declare fp1 of type FILE *
  fp1 = coder.opaque('FILE *');
  %Create the variable fp1
  fp1 = coder.ceval('fopen', ['testfile.txt', char(0)], ['r', char(0)]);
  ```

- In the MATLAB environment, `coder.opaque` returns the value specified in `value`. If `value` is not provided, it returns the empty string.
- You can compare variables declared using either `coder.opaque` or assignment from a variable declared using `coder.opaque`. The variables must have identical types. The following example demonstrates how to compare these variables. “Compare Variables Declared Using `coder.opaque`” on page 2-90
- To avoid multiple inclusions of the same header file in generated code, enclose the header file in the conditional preprocessor statements `#ifndef` and `#endif`. For example:

  ```
  #ifndef MyHeader_h
  #define MyHeader_h
  <body of header file>
  #endif
  ```

- You can use the MATLAB `cast` function to cast a variable to or from a variable that is declared using `coder.opaque`. Use `cast` with `coder.opaque` only for numeric types.

  To cast a variable declared by `coder.opaque` to a MATLAB type, you can use the `B = cast(A,type)` syntax. For example:

  ```
  x = coder.opaque('size_t','0');
  ```

```
x1 = cast(x, 'int32');
```

You can also use the `B = cast(A,'like',p)` syntax. For example:

```
x = coder.opaque('size_t','0');
x1 = cast(x, 'like', int32(0));
```

To cast a MATLAB variable to the type of a variable declared by `coder.opaque`, you must use the `B = cast(A,'like',p)` syntax. For example:

```
x = int32(12);
x1 = coder.opaque('size_t', '0');
x2 = cast(x, 'like', x1));
```

Use `cast` with `coder.opaque` to generate the correct data types for:

- Inputs to C/C++ functions that you call using `coder.ceval`.
- Variables that you assign to outputs from C/C++ functions that you call using `coder.ceval`.

Without this casting, it is possible to receive compiler warnings during code generation.

- "Specify Build Configuration Parameters"

See Also
`coder.ceval` | `coder.ref` | `coder.rref` | `coder.wref`

Introduced in R2011a

coder.ref

Package: coder

Pass argument by reference as read input or write output

Syntax

`[y =] coder.ceval('`*`function_name`*`', `**`coder.ref(`*`arg`*`)`**`, ... `*`un`*`)`

Arguments

`arg`

Variable passed by reference as an input or an output to the external C/C++ function called in `coder.ceval`. *`arg`* must be a scalar variable, a matrix variable, or an element of a matrix variable.

Description

`[y =] coder.ceval('`*`function_name`*`', `**`coder.ref(`*`arg`*`)`**`, ... `*`un`*`)` passes the variable *`arg`* by reference as an input or an output to the external C/C++ function called in `coder.ceval`. You add `coder.ref` inside `coder.ceval` as an argument to *`function_name`*. The argument list can contain multiple `coder.ref` constructs. Add a separate `coder.ref` construct for each argument that you want to pass by reference to *`function_name`*.

Only use `coder.ref` in MATLAB code that you have compiled with `codegen`. `coder.ref` generates an error in uncompiled MATLAB code.

Examples

In the following example, a MATLAB function `fcn` has a single input `u` and a single output `y`. `fcn` calls a C function `my_fcn`, passing `u` by reference as an input. The value of output `y` is passed to `fcn` by the C function through its `return` statement.

Here is the MATLAB function code:

```
function y = fcn(u) %#codegen

y = 0; %Constrain return type to double
y = coder.ceval('my_fcn', coder.ref(u));
```

The C function prototype for `my_fcn` must be as follows:

```
double my_fcn(double *u)
```

In this example, the generated code infers the type of the input `u` from the `codegen` argument.

The C function prototype defines the input as a pointer because it is passed by reference.

The generated code cannot infer the type of the output `y`, so you must set it explicitly—in this case to a constant value 0 whose type defaults to `double`.

See Also

`coder.ceval` | `coder.rref` | `coder.wref`

Introduced in R2011a

coder.resize

Package: coder

Resize a `coder.Type` object

Syntax

```
t_out = coder.resize(t, sz, variable_dims)
t_out = coder.resize(t, sz)
t_out = coder.resize(t,[],variable_dims)
t_out = coder.resize(t, sz, variable_dims, Name, Value)
t_out = coder.resize(t, 'sizelimits', limits)
```

Description

`t_out = coder.resize(t, sz, variable_dims)` returns a modified copy of `coder.Type` `t` with upper-bound size `sz`, and variable dimensions `variable_dims`. If `variable_dims` or `sz` are scalars, the function applies them to all dimensions of `t`. By default, `variable_dims` does not apply to dimensions where `sz` is `0` or `1`, which are fixed. Use the 'uniform' option to override this special case. `coder.resize` ignores `variable_dims` for dimensions with size `inf`. These dimensions are always variable size. `t` can be a cell array of types, in which case, `coder.resize` resizes all elements of the cell array.

`t_out = coder.resize(t, sz)` resizes `t` to have size `sz`.

`t_out = coder.resize(t,[],variable_dims)` changes `t` to have variable dimensions `variable_dims` while leaving the size unchanged.

`t_out = coder.resize(t, sz, variable_dims, Name, Value)` resizes `t` using additional options specified by one or more Name, Value pair arguments.

`t_out = coder.resize(t, 'sizelimits', limits)` resizes `t` with dimensions becoming variable based on the `limits` vector. When the size `S` of a dimension is greater than or equal to the first threshold defined in `limits`, the dimension becomes variable size with upper bound `S`. When the size `S` of a dimension is greater than or equal to the second threshold defined in `limits`, the dimension becomes unbounded variable size.

Input Arguments

`limits`

Two-element vector (or a scalar-expanded, one-element vector) of variable-sizing thresholds. If the size `sz` of a dimension of `t` is greater than or equal to the first threshold, the dimension becomes variable size with upper bound `sz`. If the size `sz` of a dimension of `t` is greater than or equal to the second threshold, the dimension becomes unbounded variable size.

`sz`

New size for `coder.Type` object, `t_out`

`t`

`coder.Type` object that you want to resize. If `t` is a `coder.CellType` object, the `coder.CellType` object must be homogeneous.

`variable_dims`

Specify whether each dimension of *t_out* is fixed or variable size.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside single quotes (`' '`). You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

`'recursive'`

Setting `recursive` to `true` resizes *t* and all types contained within it.

Default: false

`'uniform'`

Setting `uniform` to `true` resizes *t* but does not apply the heuristic for dimensions of size one.

Default: false

Output Arguments

`t_out`

Resized `coder.Type` object

Examples

Change a fixed-size array to a bounded, variable-size array.

```
t = coder.typeof(ones(3,3))
% t is     3x3
coder.resize(t, [4 5], 1)
% returns :4 x :5
% ':' indicates variable-size dimensions
```

Change a fixed-size array to an unbounded, variable-size array.

```
t = coder.typeof(ones(3,3))
% t is 3x3
coder.resize(t, inf)
% returns :inf x :inf
% ':' indicates variable-size dimensions
% 'inf' indicates unbounded dimensions
```

Resize a structure field.

```
ts = coder.typeof(struct('a', ones(3, 3)))
% returns field a as 3x3
coder.resize(ts, [5, 5], 'recursive', 1)
% returns field as 5x5
```

Resize a cell array.

```
tc = coder.typeof({1 2 3})
% returns 1x3 cell array
coder.resize(tc, [5, 5], 'recursive', 1)
% returns cell array as 5x5
```

Make a fixed-sized array variable size based on bounded and unbounded thresholds.

```
t = coder.typeof(ones(100,200))
% t is 100x200
```

```
coder.resize(t,'sizelimits', [99 199])
% returns :100x:inf
% ':' indicates variable-size dimensions
% :inf is unbounded variable size
```

See Also

`codegen` | `coder.typeof` | `coder.newtype`

coder.rref

Package: coder

Pass argument by reference as read-only input

Syntax

```
[y =] coder.ceval('function_name', coder.rref(argI), ... un)
```

Arguments

argI

Variable passed by reference as a *read-only* input to the external C/C++ function called in `coder.ceval`.

Description

`[y =] coder.ceval('`*`function_name`*`',` **`coder.rref(`*`argI`*`)`**`, ...` u_n`)` passes the variable *`argI`* by reference as a *read-only* input to the external C/C++ function called in `coder.ceval`. You add `coder.rref` inside `coder.ceval` as an argument to *`function_name`*. The argument list can contain multiple `coder.rref` constructs. Add a separate `coder.rref` construct for each read-only argument that you want to pass by reference to *`function_name`*.

Caution The generated code assumes that a variable passed by `coder.rref` is *read-only* and is optimized accordingly. Consequently, the C/C++ function must not write to the variable or results can be unpredictable.

Only use `coder.rref` in MATLAB code that you have compiled with `codegen`. `coder.rref` generates an error in uncompiled MATLAB code.

Examples

In the following example, a MATLAB function `fcn` has a single input `u` and a single output `y`. `fcn` calls a C function `foo`, passing `u` by reference as a read-only input. The value of output `y` is passed to `fcn` by the C function through its `return` statement.

Here is the MATLAB function code:

```
function y = fcn(u) %#codegen

y = 0; % Constrain return type to double
y = coder.ceval('foo', coder.rref(u));
```

The C function prototype for `foo` must be as follows:

```
double foo(const double *u)
```

In this example, the generated code infers the type of the input `u` from the `codegen` argument.

The C function prototype defines the input as a pointer because it is passed by reference.

The generated code cannot infer the type of the output `y`, so you must set it explicitly—in this case to a constant value 0 whose type defaults to `double`.

See Also

| | | | `coder.ceval` | `coder.opaque` | `coder.ref` | `coder.wref`

Introduced in R2011a

coder.runTest

Run test replacing calls to MATLAB functions with calls to MEX functions

Syntax

```
coder.runTest(test,fcn)
coder.runTest(test,fcns,mexfcn)
coder.runTest(test,mexfile)
```

Description

`coder.runTest(test,fcn)` runs `test` replacing calls to `fcn` with calls to the compiled version of `fcn`. `test` is the file name for a MATLAB function or script that calls the MATLAB function `fcn`. The compiled version of `fcn` must be in a MEX function that has the default name. The default name is the name specified by `fcn` followed by `_mex`.

`coder.runTest(test,fcns,mexfcn)` replaces calls to the specified MATLAB functions with calls to the compiled versions of the functions. The MEX function `mexfcn` must contain the compiled versions of all of the specified MATLAB functions.

`coder.runTest(test,mexfile)` replaces a call to a MATLAB function with a call to the compiled version of the function when the compiled version of the function is in `mexfile`. `mexfile` includes the platform-specific file extension. If `mexfile` does not contain the compiled version of a function, `coder.runTest` runs the original MATLAB function. If you do not want to specify the individual MATLAB functions to replace, use this syntax.

Examples

Run Test File Replacing One Function

Use `coder.runTest` to run a test file. Specify replacement of one MATLAB function with the compiled version. You do not provide the name of the MEX function that contains the compiled version. Therefore, `coder.runTest` looks for a MEX function that has the default name.

In a local, writable folder, create a MATLAB function, `myfun`.

```
function y = myfun(u,v) %#codegen
y = u+v;
end
```

In the same folder, create a test function, `mytest1`, that calls `myfun`.

```
function mytest1
c = myfun(10,20);
disp(c);
end
```

Run the test function in MATLAB.

```
mytest1
```

```
    30
```

Generate a MEX function for `myfun`.

```
codegen myfun -args {0,0}
```

In the current folder, `codegen` generates a MEX function that has the default name, `myfun_mex`.

Run `coder.runTest`. Specify that you want to run the test file `mytest1`. Specify replacement of `myfun` with the compiled version in `myfun_mex`.

```
coder.runTest('mytest1','myfun')
```

```
    30
```

The results are the same as when you run `mytest1` at the MATLAB command line.

Replace Multiple Functions That You Specify

Use `coder.runTest` to run a test file. Specify replacement of two functions with calls to the compiled versions. Specify the MEX function that contains the compiled versions of the functions.

In a local writable folder, create a MATLAB function, `myfun1`.

```
function y = myfun1(u) %#codegen
y = u;
end
```

In the same folder, create another MATLAB function, `myfun2`.

```
function y = myfun2(u, v) %#codegen
y = u + v;
end
```

In the same folder, create a test function that calls `myfun1` and `myfun2`.

```
function mytest2
c1 = myfun1(10);
disp(c1)
c2 = myfun2(10,20);
disp(c2)
end
```

Run the test function.

```
mytest2
```

```
    10

    30
```

Generate a MEX function for `myfun1` and `myfun2`. Use the `-o` option to specify the name of the generated MEX function.

```
codegen -o mymex  myfun1 -args {0} myfun2 -args {0,0}
```

Run `coder.runTest`. Specify that you want to run `mytest2`. Specify that you want to replace the calls to `myfun1` and `myfun2` with calls to the compiled versions in the MEX function `mymex`.

```
coder.runTest('mytest2',{'myfun1','myfun2'},'mymex')
```

```
    10

    30
```

The results are the same as when you run `mytest2` at the MATLAB command line.

Replace Functions That Have Compiled Versions in Specified MEX File

Use `coder.runTest` to run a test that replaces calls to MATLAB functions in the test with calls to the compiled versions. Specify the file name for the MEX function that contains the compiled versions of the functions.

In a local writable folder, create a MATLAB function, `myfun1`.

```
function y = myfun1(u) %#codegen
y = u;
end
```

In the same folder, create another MATLAB function, `myfun2`.

```
function y = myfun2(u, v) %#codegen
y = u + v;
end
```

In the same folder, create a test function that calls `myfun1` and `myfun2`.

```
function  mytest2
c1 = myfun1(10);
disp(c1)
c2 = myfun2(10,20);
disp(c2)
end
```

Run the test.

```
mytest2
```

```
    10

    30
```

Generate a MEX function for `myfun1` and `myfun2`. Use the `-o` option to specify the name of the generated MEX function.

```
codegen -o mymex  myfun1 -args {0} myfun2 -args {0,0}
```

Run `coder.runTest`. Specify that you want to run `mytest2`. Specify that you want to replace calls to functions called by `mytest2` with calls to the compiled versions in `mymex`. Specify the complete MEX file name including the platform-specific extension. Use `mexext` to get the platform-specific extension.

```
coder.runTest('mytest2',['mymex.', mexext])
```

```
    10

    30
```

The results are the same as when you run `mytest2` at the MATLAB command line.

Input Arguments

`test` — File name for test function or script

string

File name for MATLAB function or script that calls the functions to replace with compiled versions of the functions.

Example: `'mytest'`

Data Types: `char`

`fcn` — Name of MATLAB function to replace

string

Name of MATLAB function to replace when running test. `coder.runTest` replaces calls to this function with calls to the compiled version of this function.

Example: `'myfun'`

Data Types: `char`

`fcns` — Names of MATLAB functions to replace

string | cell array of strings

Names of MATLAB functions to replace when running test. `coder.runTest` replaces calls to these functions with calls to the compiled versions of these functions.

Specify one function as a string.

Example: `'myfun'`

Specify multiple functions as a cell array of strings. Before using `coder.runTest`, compile these functions into a single MEX function.

Example: `{'myfun1', 'myfun2', 'myfun3'}`

Data Types: `char | cell`

`mexfcn` — MEX function name

string

Name of a MEX function generated for one or more functions.

Generate this MEX function using the MATLAB Coder app or the `codegen` function.

Example: `'mymex'`

Data Types: `char`

`mexfile` — MEX file name with extension
string

The file name and platform-specific extension of a MEX file for one or more functions. Use `mexext` to get the platform-specific MEX file extension.

Generate this MEX file using the MATLAB Coder app or the `codegen` function.

Example: `['myfunmex.', mexext]`

Data Types: `char`

More About

Tips

- `coder.runTest` does not return outputs. To see test results, in the test, include code that displays the results.
- To compare MEX and MATLAB function behavior:
  - Run the test in MATLAB.
  - Use `codegen` to generate a MEX function.
  - Use `coder.runTest` to run the test replacing the call to the original function with a call to the compiled version in the MEX function.
- Before using `coder.runTest` to test multiple functions, compile the MATLAB functions into a single MEX function.
- If you use the syntax `coder.runTest(test, mexfile)`, use `mexext` to get the platform-specific MEX file name extension. For example:

  ```
  coder.runTest('my_test', ['mymexfun.', mexext])
  ```
- If errors occur during the test, you can debug the code using call stack information.
- “MATLAB Code Analysis”

See Also

`codegen` | `coder` | `coder.getArgTypes`

Introduced in R2012a

coder.screener

Determine if function is suitable for code generation

Syntax

```
coder.screener(fcn)
coder.screener(fcn_1,...,fcn_n )
```

Description

`coder.screener(fcn)` analyzes the entry-point MATLAB function, `fcn`. It identifies unsupported functions and language features, such as recursion and nested functions, as code generation compliance issues. It displays the code generation compliance issues in a report. If `fcn` calls other functions directly or indirectly that are not MathWorks® functions, `coder.screener` analyzes these functions. It does not analyze MathWorks functions. It is possible that `coder.screener` does not detect all code generation issues. Under certain circumstances, it is is possible that `coder.screener` reports false errors.

`coder.screener(fcn_1,...,fcn_n )` analyzes entry-point functions (`fcn_1,...,fcn_n`).

Input Arguments

`fcn`

Name of entry-point MATLAB function that you want to analyze.

`fcn_1,...,fcn_n`

Comma-separated list of names of entry-point MATLAB functions that you want to analyze.

Examples

Identify Unsupported Functions

The `coder.screener` function identifies calls to functions that are not supported for code generation. It checks both the entry-point function, `foo1`, and the function `foo2` that `foo1` calls.

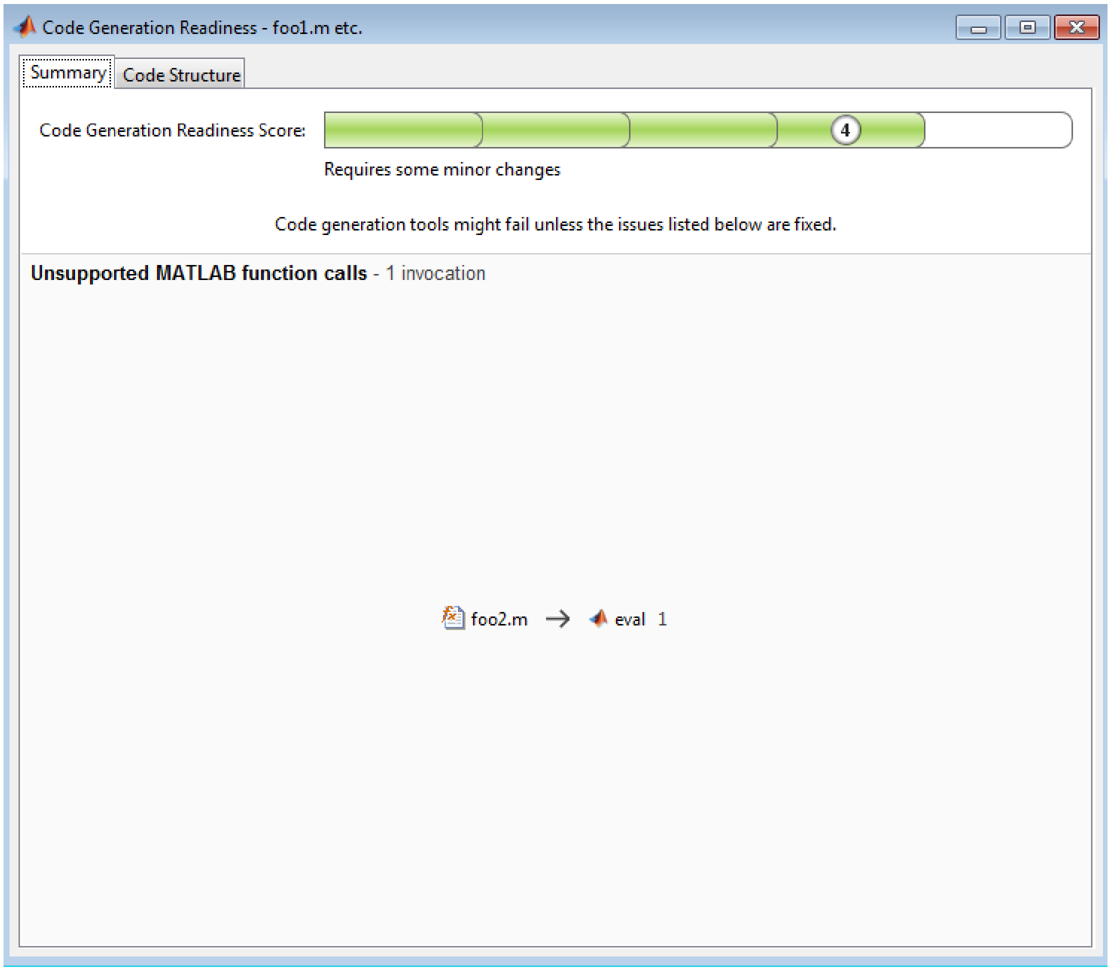
Analyze the MATLAB function `foo1` that calls `foo2`. Put `foo1` and `foo2` in separate files.

```
function out = foo1(in)
  out = foo2(in);
  disp(out);
end

function out = foo2(in)
  out = eval(in);
end

coder.screener('foo1')
```

The code generation readiness report displays a summary of the unsupported MATLAB function calls. The function `foo2` calls one unsupported MATLAB function.


Code Generation Readiness - foo1.m etc.

Code Generation Readiness Score: 4

Requires some minor changes

Code generation tools might fail unless the issues listed below are fixed.

Unsupported MATLAB function calls - 1 invocation

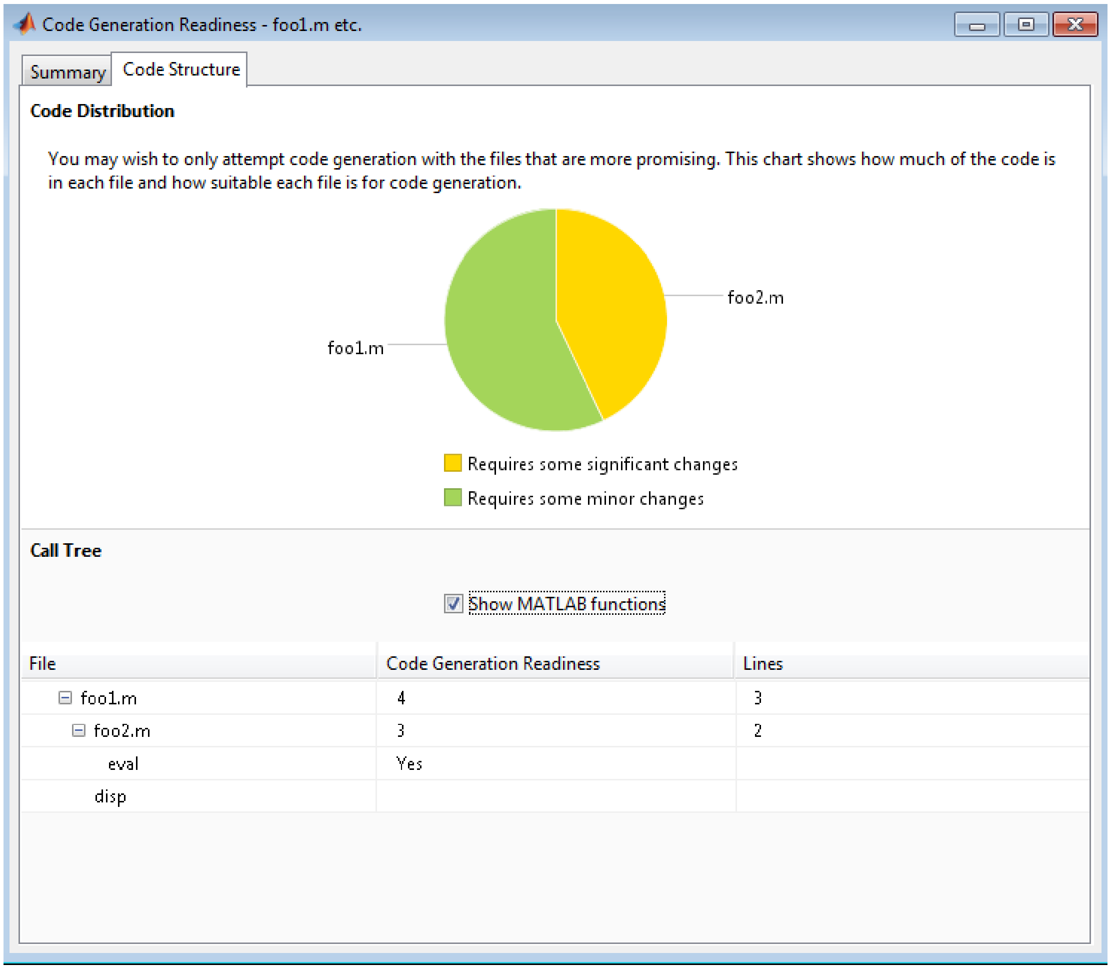
foo2.m → eval 1

In the report, click the **Code Structure** tab and select the **Show MATLAB functions** check box.

This tab displays a pie chart showing the relative size of each file and how suitable each file is for code generation. In this case, the report:

- Colors `foo1.m` green to indicate that it is suitable for code generation.
- Colors `foo2.m` yellow to indicate that it requires significant changes.

- Assigns `foo1.m` a code generation readiness score of 4 and `foo2.m` a score of 3. The score is based on a scale of 1–5. 1 indicates that significant changes are required; 5 indicates that the code generation readiness tool does not detect issues.
- Displays a call tree.



Code Distribution

You may wish to only attempt code generation with the files that are more promising. This chart shows how much of the code is in each file and how suitable each file is for code generation.

🟨 Requires some significant changes

🟩 Requires some minor changes

Call Tree

☑ Show MATLAB functions

File	Code Generation Readiness	Lines
⊟ foo1.m	4	3
⊟ foo2.m	3	2
eval	Yes	
disp		

The report **Summary** tab indicates that `foo2.m` contains one call to the `eval` function which code generation does not support. To generate a MEX function for `foo2.m`, modify the code to make the call to `eval` extrinsic.

```
function out = foo2(in)
  coder.extrinsic('eval');
  out = eval(in);
end
```

Rerun the code generation readiness tool.

```
coder.screener('foo1')
```

The report no longer flags that code generation does not support the `eval` function. When you generate a MEX function for `foo1`, the code generation software dispatches `eval` to MATLAB for execution. For standalone code generation, it does not generate code for it.

Identify Unsupported Data Types

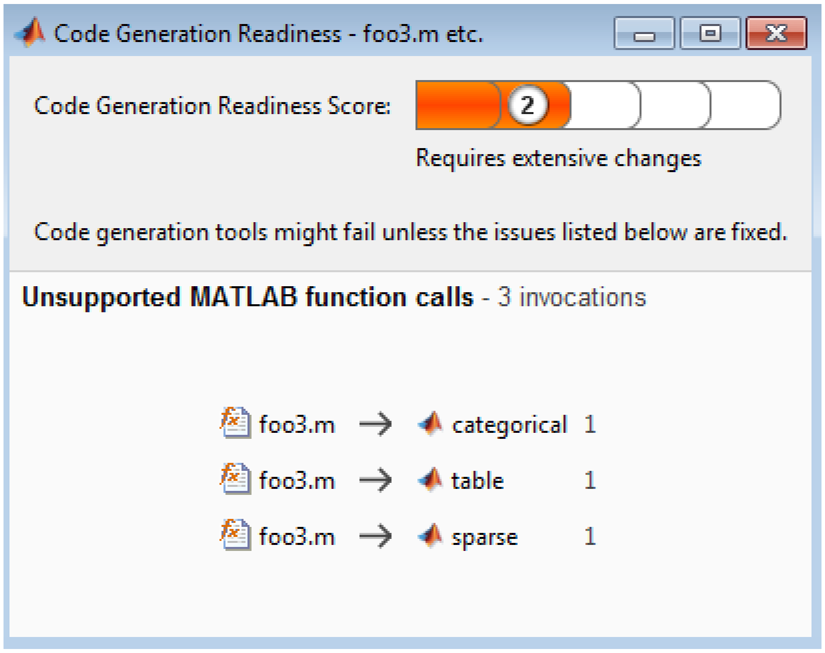
The `coder.screener` function identifies data types that code generation does not support.

Analyze the MATLAB function `foo3` that uses unsupported data types.

```
function [outSparse,outCategorical] = foo3(A,B,C)
    outSparse = sparse(A);
    outCategorical = categorical(B);
    outTable = table(C);
end
```

```
coder.screener('foo3')
```

The code generation readiness report displays a summary of the unsupported data types.


Code Generation Readiness - foo3.m etc.

Code Generation Readiness Score: 2

Requires extensive changes

Code generation tools might fail unless the issues listed below are fixed.

Unsupported MATLAB function calls - 3 invocations

foo3.m	→	categorical	1
foo3.m	→	table	1
foo3.m	→	sparse	1

The report assigns the code a code readiness score of 2. This score indicates that the code requires extensive changes.

Before generating code, you must fix the reported issues.

Determine Code Generation Readiness for Multiple Entry-Point Functions

The `coder.screener` function identifies calls to functions that code generation does not support. It checks the entry-point functions `foo4` and `foo5`.

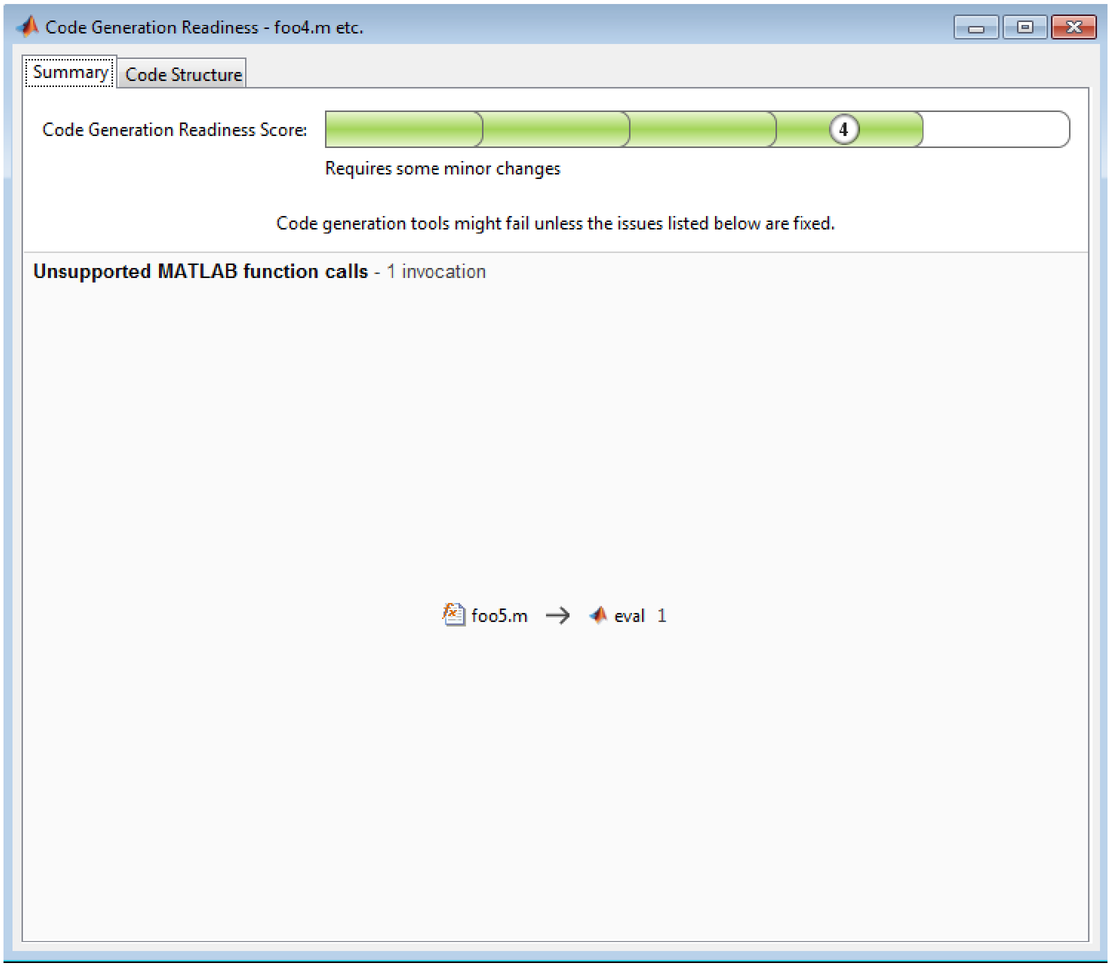
Analyze the MATLAB functions `foo4` and `foo5`.

```
function out = foo4(in)
  out = in;
  disp(out);
end

function out = foo5(in)
  out = eval(in);
end
```

```
coder.screener('foo4', 'foo5')
```

The code generation readiness report displays a summary of the unsupported MATLAB function calls. The function `foo5` calls one unsupported MATLAB function.



Code Generation Readiness Score:

Requires some minor changes

Code generation tools might fail unless the issues listed below are fixed.

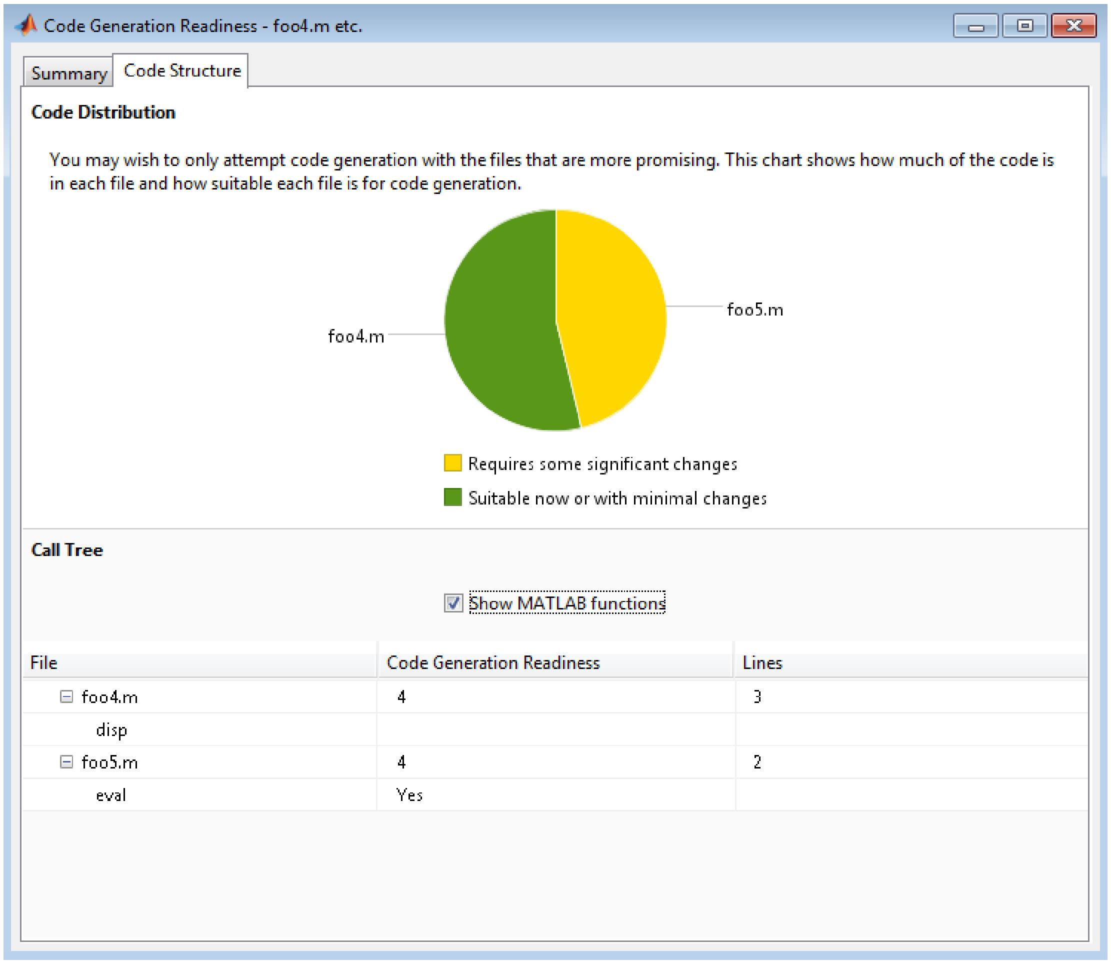
Unsupported MATLAB function calls - 1 invocation

foo5.m → eval 1

In the report, click the **Code Structure** tab. Select the **Show MATLAB functions** check box.

This tab displays a pie chart showing the relative size of each file and how suitable each file is for code generation. In this case, the report:

- Colors `foo4.m` green to indicate that it is suitable for code generation.
- Colors `foo5.m` yellow to indicate that it requires significant changes.
- Assigns `foo4.m` a code generation readiness score of 4 and `foo5.m` a score of 4. The score is based on a scale of 1–5. 1 indicates that significant changes are required; 5 indicates that the code generation readiness tool cannot detect issues.
- Displays a call tree.


Code Generation Readiness - foo4.m etc.
Summary
Code Structure
Code Distribution

You may wish to only attempt code generation with the files that are more promising. This chart shows how much of the code is in each file and how suitable each file is for code generation.

foo4.m
foo5.m
🟨 Requires some significant changes
🟩 Suitable now or with minimal changes
Call Tree
Show MATLAB functions

☑ Show MATLAB functions

File	Code Generation Readiness	Lines
⊟ foo4.m	4	3
disp		
⊟ foo5.m	4	2
eval	Yes	

Alternatives

- "Run Code Generation Readiness Tool from the Current Folder Browser"
- "Run the Code Generation Readiness Tool Using the MATLAB Coder App".

More About

Tips

- Before using `coder.screener`, fix issues that the Code Analyzer identifies.
- Before generating code, use `coder.screener` to check that a function is suitable for code generation. Fix all the issues that it detects.
- It is possible that `coder.screener` does not detect all issues, and can report false errors. Therefore, before generating C code, verify that your code is suitable for code generation by generating a MEX function.

- "MATLAB Language Features Supported for C/C++ Code Generation"
- "Functions and Objects Supported for C and C++ Code Generation — Alphabetical List"
- "Functions and Objects Supported for C and C++ Code Generation — Category List"
- "Code Generation Readiness Tool"

See Also

`codegen`

Introduced in R2012b

coder.target

Determine if code generation target is specified target

Syntax

```
tf = coder.target(target)
```

Description

`tf = coder.target(target)` returns true (1) if the code generation target is `target`. Otherwise, it returns false (0).

If you generate code for MATLAB classes, MATLAB computes class initial values at class loading time before code generation. If you use `coder.target` in MATLAB class property initialization, `coder.target('MATLAB')` returns true.

Examples

Use coder.target to parameterize a MATLAB function

Parameterize a MATLAB function so that it works in MATLAB or generated code. When the function runs in MATLAB, it calls the MATLAB function `myabsval`. The generated code, however, calls a C library function `myabsval`.

Write a MATLAB function `myabsval`.

```
function y = myabsval(u)   %#codegen
y = abs(u);
```

Generate the C library for `myabsval.m`, using the `-args` option to specify the size, type, and complexity of the input parameter.

```
codegen -config:lib myabsval -args {0.0}
```

`codegen` creates the library `myabsval.lib` and header file `myabsval.h` in the folder `/codegen/lib/myabsval`. It also generates the functions `myabsval_initialize` and `myabsval_terminate` in the same folder.

Write a MATLAB function to call the generated C library function using `coder.ceval`.

```
function y = callmyabsval  %#codegen
y = -2.75;
% Check the target. Do not use coder.ceval if callmyabsval is
% executing in MATLAB
if coder.target('MATLAB')
  % Executing in MATLAB, call function myabsval
  y = myabsval(y);
else
  % Executing in the generated code.
  % Call the initialize function before calling the
  % C function for the first time
  coder.ceval('myabsval_initialize');

  % Call the generated C library function myabsval
  y = coder.ceval('myabsval',y);

  % Call the terminate function after
  % calling the C function for the last time
  coder.ceval('myabsval_terminate');
end
```

Convert `callmyabsval.m` to the MEX function `callmyabsval_mex`.

```
codegen -config:mex callmyabsval codegen/lib/myabsval/myabsval.lib...
     codegen/lib/myabsval/myabsval.h
```

Run the MATLAB function `callmyabsval` .

```
callmyabsval

ans =

    2.7500
```

Run the MEX function `callmyabsval_mex` which calls the library function `myabsval`.

```
callmyabsval_mex

ans =
    2.7500
```

Input Arguments

`target` — code generation target
string

Code generation target specified as one of the following strings:

`'MATLAB'`	Running in MATLAB (not generating code)
`'MEX'`	Generating a MEX function
`'Sfun'`	Simulating a Simulink model
`'Rtw'`	Generating a LIB, DLL, or EXE target
`'HDL '`	Generating an HDL target
`'Custom'`	Generating a custom target

Example: `tf = coder.target('MATLAB')`

Data Types: `char`

See Also

`coder.ceval`

Introduced in R2011a

coder.typeof

Package: coder

Convert MATLAB value into its canonical type

Syntax

```
t = coder.typeof(v)
t = coder.typeof(v, sz, variable_dims)
t = coder.typeof(t)
```

Description

`t = coder.typeof(v)` creates a `coder.Type` object denoting the smallest nonconstant type that contains `v`. `v` must be a MATLAB numeric, logical, char, enumeration or fixed-point array, or a cell array or struct constructed from these types. Use `coder.typeof` to specify only input parameter types. For example, use it with the `codegen` function `-args` option or in a MATLAB Coder project when you are defining an input type by example. Do not use it in MATLAB code from which you intend to generate code.

`t = coder.typeof(v, sz, variable_dims)` returns a modified copy of `t` = coder.typeof(`v`) with (upper bound) size specified by `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is unbounded and the dimension is variable size. When `sz` is `[]`, the (upper bound) sizes of `v` do not change. If you do not specify the `variable_dims` input parameter, the bounded dimensions of the type are fixed. When `variable_dims` is a scalar, it is applied to bounded dimensions or dimensions that are `1` or `0`, which are fixed.

When `v` is a cell array whose elements have the same classes, but different sizes, if you specify variable-size dimensions, `coder.typeof` creates a homogeneous cell array type. If the elements have different classes, `coder.typeof` reports an error.

`t = coder.typeof(t)`, where `t` is a `coder.Type` object, returns `t` itself.

Input Arguments

`sz`

Size vector specifying each dimension of type object.

`t`

`coder.Type` object

`v`

MATLAB expression that describes the set of values represented by this type.

`v` must be a MATLAB numeric, logical, char, enumeration or fixed-point array, or a cell array or struct constructed from the preceding types.

`variable_dims`

Logical vector that specifies whether each dimension is variable size (true) or fixed size (false).

For a cell array, if the elements have different classes, you cannot specify variable-size dimensions.

Output Arguments

`t`

`coder.Type` object

Examples

Create a type for a simple fixed-size `5x6` matrix of doubles.

```
coder.typeof(ones(5, 6))
 % returns 5x6 double
coder.typeof(0, [5 6])
 % also returns 5x6 double
```

Create a type for a variable-size matrix of doubles.

```
coder.typeof(ones(3,3), [], 1)
% returns :3 x :3 double
% ':' indicates variable-size dimensions
```

Create a type for a structure with a variable-size field.

```
x.a = coder.typeof(0,[3 5],1);
x.b = magic(3);
coder.typeof(x)
% Returns
% coder.StructType
%    1x1 struct
%      a:  :3x:5 double
%      b:  3x3  double
% ':' indicates variable-size dimensions
```

Create a type for a homogeneous cell array with a variable-size field.

```
a = coder.typeof(0,[3 5],1);
b = magic(3);
coder.typeof({a b})
% Returns
% coder.CellType
%   1x2 homogeneous cell
%      base: :3x:5 double
% ':' indicates variable-size dimensions
```

Create a type for a heterogeneous cell array.

```
a = coder.typeof('a');
b = coder.typeof(1);
coder.typeof({a b})
% Returns
% coder.CellType
%   1x2 heterogeneous cell
%      f0: 1x1 char
%      f1: 1x1 double
```

Create a variable-size homogeneous cell array type from a cell array that has the same class but different sizes.

1 Create a type for a cell array that has two strings with different sizes. The cell array type is heterogeneous.

```
coder.typeof({'aa', 'bbb'})
% Returns
% coder.CellType
%   1x2 heterogeneous cell
%      f0: 1x2 char
%      f1: 1x3 char
```

2 Create a type using the same cell array input. This time, specify that the cell array type has variable-size dimensions. The cell array type is homogeneous.

```
coder.typeof({'aa','bbb'},[1,10],[0,1])
% Returns
% coder.CellType
%   1x:10 homogeneous cell
%      base: 1x:3 char
```

Create a type for a matrix with fixed-size and variable-size dimensions.

```
coder.typeof(0, [2,3,4], [1 0 1]);
% Returns :2x3x:4 double
% ':' indicates variable-size dimensions
```

```
coder.typeof(10, [1 5], 1)
% returns double 1 x  :5
% ':' indicates variable-size dimensions
```

Create a type for a matrix of doubles, first dimension unbounded, second dimension with fixed size.

```
coder.typeof(10,[inf,3])
% returns double:inf x 3
% ':' indicates variable-size dimensions
```

Create a type for a matrix of doubles, first dimension unbounded, second dimension with variable size with an upper bound of 3.

```
coder.typeof(10, [inf,3],[0 1])
% returns double :inf x :3
% ':' indicates variable-size dimensions
```

Convert a fixed-size matrix to a variable-size matrix.

```
 coder.typeof(ones(5,5), [], 1)
% returns double :5x:5
% ':' indicates variable-size dimensions
```

Create a nested structure (a structure as a field of another structure).

```
S = struct('a',double(0),'b',single(0))
SuperS.x = coder.typeof(S)
SuperS.y = single(0)
coder.typeof(SuperS)
% Returns
% coder.StructType
% SuperS:  1x1 struct
%   with fields
%      x:  1x1 struct
%         with fields
%             a: 1x1 double
%             b: 1x1 single
%      y:  1x1  single
```

Create a structure containing a variable-size array of structures as a field.

```
S = struct('a',double(0),'b',single(0))
SuperS.x = coder.typeof(S,[1 inf],[0 1])
SuperS.y = single(0)
coder.typeof(SuperS)
% Returns
% coder.StructType
% SuperS:  1x1 struct
%   with fields
%      x:  1x:inf struct
%         with fields
%             a: 1x1 double
%             b: 1x1 single
%      y:  1x1  single
% ':' indicates variable-size dimensions
```

Tips

- If you are already specifying the type of an input variable using a type function, do not use `coder.typeof` unless you also want to specify the size. For instance, instead of `coder.typeof(single(0))`, use the syntax `single(0)`.
- For cell array types, `coder.typeof` determines whether the cell array type is homogeneous or heterogeneous. If the cell array elements have the same class and size, `coder.typeof` returns a homogeneous cell array type. If the elements have different classes, `coder.typeof` returns a heterogeneous cell array type. For some cell arrays, the classification as homogeneous or heterogeneous is ambiguous.

For example, the type for {1 [2 3]} can be a 1x2 heterogeneous type where the first element is double and the second element is 1x2 double. The type can also be a 1x3 homogeneous type in which the elements have class double and size 1x:2. For these ambiguous cases, `coder.typeof` uses heuristics to classify the type as homogeneous or heterogeneous. If you want a different classification, use the coder.CellType `makeHomogeneous` or `makeHeterogeneous` methods to make a type with the classification that you want. The `makeHomogeneous` method makes a homogeneous copy of a type. The `makeHeterogeneous` method makes a heterogeneous copy of a type.

The `makeHomogeneous` and `makeHeterogeneous` methods permanently assign the classification as heterogeneous and homogeneous, respectively. You cannot later use one of these methods to create a copy that has a different classification.

See Also

coder.CellType | | `codegen` | coder.ArrayType | coder.EnumType | coder.FiType | `coder.newtype` | coder.PrimitiveType | `coder.resize` | coder.StructType | coder.Type

Introduced in R2011a

coder.unroll

Package: coder

Copy body of `for`-loop in generated code for each iteration

Syntax

```
for i = coder.unroll(range)
for i = coder.unroll(range,flag)
```

Description

`for i = coder.unroll(range)` copies the body of a `for`-loop (unrolls a `for`-loop) in generated code for each iteration specified by the bounds in *`range`*. *`i`* is the loop counter variable.

`for i = coder.unroll(range,flag)` unrolls a `for`-loop as specified in *`range`* if *`flag`* is `true`.

You must use `coder.unroll` in a `for`-loop header. `coder.unroll` modifies the generated code, but does not change the computed results.

`coder.unroll` must be able to evaluate the bounds of the `for`-loop at compile time. The number of iterations cannot exceed 1024; unrolling large loops can increase compile time significantly and generate inefficient code

This function is ignored outside of code generation.

Input Arguments

`flag`

Boolean expression that indicates whether to unroll the `for`-loop:

`true`	Unroll the `for`-loop

`false`	Do not unroll the `for`-loop

`range`

Specifies the bounds of the `for`-loop iteration:

`init_val` `:` *`end_val`*	Iterate from *`init_val`* to *`end_val`*, using an increment of 1
`init_val` `:` *`step_val`* `:` *`end_val`*	Iterate from *`init_val`* to *`end_val`*, using *`step_val`* as an increment if positive or as a decrement if negative
Matrix variable	Iterate for a number of times equal to the number of columns in the matrix

Examples

To limit the number of times to copy the body of a `for`-loop in generated code:

1 Write a MATLAB function `getrand(n)` that uses a `for`-loop to generate a vector of length `n` and assign random numbers to specific elements. Add a test function `test_unroll`. This function calls `getrand(n)` with `n` equal to values both less than and greater than the threshold for copying the `for`-loop in generated code.

```
function [y1, y2] = test_unroll() %#codegen
% The directive %#codegen indicates that the function
% is intended for code generation
  % Calling getrand 8 times triggers unroll
  y1 = getrand(8);
  % Calling getrand 50 times does not trigger unroll
  y2 = getrand(50);

function y = getrand(n)
  % Turn off inlining to make
  % generated code easier to read
  coder.inline('never');

  % Set flag variable dounroll to repeat loop body
  % only for fewer than 10 iterations
  dounroll = n < 10;
  % Declare size, class, and complexity
  % of variable y by assignment
  y = zeros(n, 1);
  % Loop body begins
  for i = coder.unroll(1:2:n, dounroll)
      if (i > 2) && (i < n-2)
          y(i) = rand();
      end;
  end;
  % Loop body ends
```

2 In the default output folder, `codegen/lib/test_unroll`, generate C static library code for `test_unroll` :

```
codegen -config:lib test_unroll
```

In `test_unroll.c`, the generated C code for `getrand(8)` repeats the body of the `for`-loop (unrolls the loop) because the number of iterations is less than 10:

```
static void getrand(double y[8])
{
  /*  Turn off inlining to make  */
  /*  generated code easier to read */
  /*  Set flag variable dounroll to repeat loop body */
  /*  only for fewer than 10 iterations */
  /*  Declare size, class, and complexity */
  /*  of variable y by assignment */
  memset(&y[0], 0, sizeof(double) << 3);

  /*  Loop body begins */
  y[2] = b_rand();
  y[4] = b_rand();

  /*  Loop body ends */
}
```

The generated C code for `getrand(50)` does not unroll the `for`-loop because the number of iterations is greater than 10:

```
static void b_getrand(double y[50])
{
  int i;
  int b_i;

  /*  Turn off inlining to make  */
  /*  generated code easier to read */
  /*  Set flag variable dounroll to repeat loop body */
  /*  only for fewer than 10 iterations */
  /*  Declare size, class, and complexity */
  /*  of variable y by assignment */
  memset(&y[0], 0, 50U * sizeof(double));

  /*  Loop body begins */
  for (i = 0; i < 25; i++) {
    b_i = (i << 1) + 1;
    if ((b_i > 2) && (b_i < 48)) {
      y[b_i - 1] = b_rand();
    }
  }
```

More About

- " Using Logicals in Array Indexing"
- "Unroll for-Loops"

See Also

`coder.inline` | `coder.nullcopy` | `for` | |

Introduced in R2011a

coder.updateBuildInfo

Update build information object `RTW.BuildInfo`

Syntax

```
coder.updateBuildInfo('addCompileFlags',options)
coder.updateBuildInfo('addLinkFlags',options)
coder.updateBuildInfo('addDefines',options)
coder.updateBuildInfo(___,group)

coder.updateBuildInfo('addLinkObjects',filename,path)
coder.updateBuildInfo('addLinkObjects',filename,path, priority,
precompiled)
coder.updateBuildInfo('addLinkObjects',filename,path, priority,
precompiled,linkonly)
coder.updateBuildInfo(___,group)

coder.updateBuildInfo('addNonBuildFiles',filename)
coder.updateBuildInfo('addSourceFiles',filename)
coder.updateBuildInfo('addIncludeFiles',filename)
coder.updateBuildInfo(___,path)
coder.updateBuildInfo(___,path,group)

coder.updateBuildInfo('addSourcePaths',path)
coder.updateBuildInfo('addIncludePaths',path)
coder.updateBuildInfo(___,group)
```

Description

`coder.updateBuildInfo('addCompileFlags',options)` adds compiler options to the build information object.

`coder.updateBuildInfo('addLinkFlags',options)` adds link options to the build information object.

`coder.updateBuildInfo('addDefines',options)` adds preprocessor macro definitions to the build information object.

`coder.updateBuildInfo( ___ ,group)` assigns a group name to `options` for later reference.

`coder.updateBuildInfo('addLinkObjects',filename,path)` adds a link object from a file to the build information object.

`coder.updateBuildInfo('addLinkObjects',filename,path, priority, precompiled)` specifies if the link object is precompiled.

`coder.updateBuildInfo('addLinkObjects',filename,path, priority, precompiled,linkonly)` specifies if the object is to be built before being linked or used for linking alone. If the object is to be built, it specifies if the object is precompiled.

`coder.updateBuildInfo( ___ ,group)` assigns a group name to the link object for later reference.

`coder.updateBuildInfo('addNonBuildFiles',filename)` adds a nonbuild-related file to the build information object.

`coder.updateBuildInfo('addSourceFiles',filename)` adds a source file to the build information object.

`coder.updateBuildInfo('addIncludeFiles',filename)` adds an include file to the build information object.

`coder.updateBuildInfo( ___ ,path)` adds the file from specified path.

`coder.updateBuildInfo( ___ ,path,group)` assigns a group name to the file for later reference.

`coder.updateBuildInfo('addSourcePaths',path)` adds a source file path to the build information object.

`coder.updateBuildInfo('addIncludePaths',path)` adds an include file path to the build information object.

`coder.updateBuildInfo( ___ ,group)` assigns a group name to the path for later reference.

Examples

Add Multiple Compiler Options

Add the compiler options `-Zi` and `-Wall` during code generation for function, `func`.

Anywhere in the MATLAB code for `func`, add the following line:

```
coder.updateBuildInfo('addCompileFlags','-Zi -Wall');
```

Generate code for `func` using the `codegen` command. Open the Code Generation Report.

```
codegen -config:lib -launchreport func
```

You can see the added compiler options under the **Target Build Log** tab in the Code Generation Report.

Add Source File Name

Add a source file to the project build information while generating code for a function, `calc_factorial`.

1 Write a header file `fact.h` that declares a C function `factorial`.

   ```
    double factorial(double x);
   ```

   `fact.h` will be included as a header file in generated code. This inclusion ensures that the function is declared before it is called.

   Save the file in the current folder.

2 Write a C file `fact.c` that contains the definition of `factorial`. `factorial` calculates the factorial of its input.

   ```
   #include "fact.h"

         double factorial(double x)
         {
             int i;
             double fact = 1.0;
             if (x == 0 || x == 1) {
                return 1.0;
            } else {
                for (i = 1; i <= x; i++) {
   ```

```
                    fact *= (double)i;
                }
                return fact;
            }
        }
```

`fact.c` is used as a source file during code generation.

Save the file in the current folder.

3. Write a MATLAB function `calc_factorial` that uses `coder.ceval` to call the external C function `factorial`.

   Use `coder.updateBuildInfo` with option `'addSourceFiles'` to add the source file `fact.c` to the build information. Use `coder.cinclude` to include the header file `fact.h` in the generated code.

   ```
   function y = calc_factorial(x) %#codegen

     coder.cinclude('fact.h');
     coder.updateBuildInfo('addSourceFiles', 'fact.c');

     y = 0;
     y = coder.ceval('factorial', x);
   ```
4. Generate code for `calc_factorial` using the `codegen` command.

   ```
    codegen -config:dll -launchreport calc_factorial -args 0
   ```

   In the Code Generation Report, on the **C Code** tab, you can see the added source file `fact.c`.

Add Link Object

Add a link object `LinkObj.lib` to the build information while generating code for a function `func`. For this example, you must have a link object `LinkObj.lib` saved in a local folder, for example, `c:\Link_Objects`.

Anywhere in the MATLAB code for `func`, add the following lines:

```
libPriority = '';
libPreCompiled = true;
libLinkOnly = true;
libName = 'LinkObj.lib';
```

```
libPath = 'c:\Link_Objects';
coder.updateBuildInfo('addLinkObjects', libName, libPath, ...
     libPriority, libPreCompiled, libLinkOnly);
```

Generate a MEX function for `func` using the `codegen` command. Open the Code Generation Report.

```
codegen -launchreport func
```

You can see the added link object under the **Target Build Log** tab in the Code Generation Report.

Add Include Paths

Add an include path to the build information while generating code for a function, `adder`. Include a header file, `adder.h`, existing on the path.

When header files do not reside in the current folder, to include them, use this method:

1. Write a header file `mysum.h` that contains the declaration for a C function `mysum`.

   ```
   double mysum(double, double);
   ```

   Save it in a local folder, for example `c:\coder\myheaders`.
2. Write a C file `mysum.c` that contains the definition of the function `mysum`.

   ```
   #include "mysum.h"

   double mysum(double x, double y)
    {
     return(x+y);
    }
   ```

   Save it in the current folder.
3. Write a MATLAB function `adder` that adds the path `c:\coder\myheaders` to the build information.

   Use `coder.cinclude` to include the header file `mysum.h` in the generated code.

   ```
   function y = adder(x1, x2) %#codegen
      coder.updateBuildInfo('addIncludePaths','c:\coder\myheaders');
      coder.updateBuildInfo('addSourceFiles','mysum.c');
        %Include the source file containing C function definition
   ```

```
        coder.cinclude('mysum.h');
        y = 0;
        if coder.target('MATLAB')
           % This line ensures that the function works in MATLAB
             y = x1 + x2;
        else
            y = coder.ceval('mysum', x1, x2);
         end
     end
```

4 Generate code for `adder` using the `codegen` command.

```
codegen -config:lib -launchreport adder -args {0,0}
```

Open the Code Generation Report. The header file `adder.h` is included in the generated code.

Input Arguments

`options` — Build options

string

Build options, specified as a string. The string must be a compile-time constant.

Depending on the leading argument, `options` specifies the relevant build options to be added to the project's build information.

Leading Argument	Values in `options`
`'addCompileFlags'`	Compiler options
`'addLinkFlags'`	Link options
`'addDefines'`	Preprocessor macro definitions

The function adds the options to the end of an option vector.

Example: `coder.updateBuildInfo('addCompileFlags','-Zi -Wall')`

`group` — Group name

string

Name of user-defined group, specified as a string. The string must be a compile-time constant.

The `group` option assigns a group name to the parameters in the second argument.

Leading Argument	Second Argument	Parameters Named by `group`
`'addCompileFlags'`	`options`	Compiler options
`'addLinkFlags'`	`options`	Link options
`'addLinkObjects'`	`filename`	Name of file containing linkable objects
`'addNonBuildFiles'`	`filename`	Name of nonbuild-related file
`'addSourceFiles'`	`filename`	Name of source file
`'addSourcePaths'`	`path`	Name of source file path

You can use `group` to:

- Document the use of specific parameters.
- Retrieve or apply multiple parameters together as one group.

`filename` — File name

string

File name, specified as a string. The string must be a compile-time constant.

Depending on the leading argument, `filename` specifies the relevant file to be added to the project's build information.

Leading Argument	File Specified by `filename`
`'addLinkObjects'`	File containing linkable objects
`'addNonBuildFiles'`	Nonbuild-related file
`'addSourceFiles'`	Source file

The function adds the file name to the end of a file name vector.

`path` — Full path name

string

Full path name, specified as a string. The string must be a compile-time constant.

Depending on the leading argument, `path` specifies the relevant path name to be added to the project's build information.

Leading Argument	Path Specified by `path`
`'addLinkObjects'`	Path to linkable objects
`'addNonBuildFiles'`	Path to nonbuild-related files
`'addSourceFiles'`, `'addSourcePaths'`	Path to source files

The function adds the path to the end of a path name vector.

`priority` — Relative priority of link object

`''`

Priority of link objects.

This feature applies only when several link objects are added. Currently, only a single link object file can be added for every `coder.updateBuildInfo` statement. Therefore, this feature is not available for use.

To use the succeeding arguments, include `''` as a placeholder argument.

`precompiled` — Variable indicating if link objects are precompiled

logical value

Variable indicating if the link objects are precompiled, specified as a logical value. The value must be a compile-time constant.

If the link object has been prebuilt for faster compiling and linking and exists in a specified location, specify `true`. Otherwise, the MATLAB Coder build process creates the link object in the build folder.

If `linkonly` is set to `true`, this argument is ignored.

Data Types: `logical`

`linkonly` — Variable indicating if objects must be used for linking only

logical value

Variable indicating if objects must be used for linking only, specified as a logical value. The value must be a compile-time constant.

If you want that the MATLAB Coder build process must not build or generate rules in the makefile for building the specified link object, specify `true`. Instead, when linking the final executable, the process should just include the object. Otherwise, rules for building the link object are added to the makefile.

You can use this argument to incorporate link objects for which source files are not available.

If `linkonly` is set to `true`, the value of `precompiled` is ignored.

Data Types: `logical`

More About

- "Customize the Post-Code-Generation Build Process"

Introduced in R2013b

coder.varsize

Package: coder

Declare variable-size array

Syntax

```
coder.varsize('var1', 'var2', ...)
coder.varsize('var1', 'var2', ..., ubound)
coder.varsize('var1', 'var2', ..., ubound, dims)
coder.varsize('var1', 'var2', ..., [], dims)
```

Description

`coder.varsize('var1', 'var2', ...)` declares one or more variables as variable-size data, allowing subsequent assignments to extend their size. Each `'varn'` must be a quoted string that represents a variable or structure field. If the structure field belongs to an array of structures, use colon (`:`) as the index expression to make the field variable-size for all elements of the array. For example, the expression `coder.varsize('data(:).A')` declares that the field `A` inside each element of `data` is variable sized.

`coder.varsize('var1', 'var2', ..., ubound)` declares one or more variables as variable-size data with an explicit upper bound specified in *`ubound`*. The argument *`ubound`* must be a constant, integer-valued vector of upper bound sizes for every dimension of each `'varn'`. If you specify more than one `'varn'`, each variable must have the same number of dimensions.

`coder.varsize('var1', 'var2', ..., ubound, dims)` declares one or more variables as variable size with an explicit upper bound and a mix of fixed and varying dimensions specified in *`dims`*. The argument *`dims`* is a logical vector, or double vector containing only zeros and ones. Dimensions that correspond to zeros or `false` in *`dims`* have fixed size; dimensions that correspond to ones or `true` vary in size. If you specify more than one variable, each fixed dimension must have the same value across all `'varn'`.

`coder.varsize('`*`var`*$_1$`', '`*`var`*$_2$`', ..., [], `*`dims`*`)` declares one or more variables as variable size with a mix of fixed and varying dimensions. The empty vector `[]` means that you do not specify an explicit upper bound.

When you do *not* specify *`ubound`*, the upper bound is computed for each `'`*`var`*$_n$`'` in generated code.

When you do *not* specify *`dims`*, dimensions are assumed to be variable except the singleton ones. A singleton dimension is a dimension for which `size(A,dim)` = 1.

You must add the `coder.varsize` declaration before each `'`*`var`*$_n$`'` is used (read). You can add the declaration before the first assignment to each `'`*`var`*$_n$`'`. However, for a cell array element, the `coder.varsize` declaration must follow the first assignment to the element. For example:

```
...
x = cell(3, 3);
x{1} = [1 2];
coder.varsize('x{1}');
...
```

You cannot use `coder.varsize` outside the MATLAB code intended for code generation. For example, the following code does not declare the variable, `var`, as variable-size data:

```
coder.varsize('var',10);
codegen -config:lib MyFile -args var
```

Instead, include the `coder.varsize` statement inside `MyFile` to declare `var` as variable-size data. Alternatively, you can use `coder.typeof` to declare `var` as variable-size outside `MyFile`. It can then be passed to `MyFile` during code generation using the `-args` option. For more information, see `coder.typeof`.

Examples

Develop a Simple Stack That Varies in Size up to 32 Elements as You Push and Pop Data at Run Time.

Write primary function `test_stack` to issue commands for pushing data on and popping data from a stack.

```
function test_stack %#codegen
    % The directive %#codegen indicates that the function
    % is intended for code generation
    stack('init', 32);
    for i = 1 : 20
        stack('push', i);
    end
    for i = 1 : 10
        value = stack('pop');
        % Display popped value
        value
    end
end
```

Write local function `stack` to execute the push and pop commands.

```
function y = stack(command, varargin)
    persistent data;
    if isempty(data)
        data = ones(1,0);
    end
    y = 0;
    switch (command)
    case {'init'}
        coder.varsize('data', [1, varargin{1}], [0 1]);
        data = ones(1,0);
    case {'pop'}
        y = data(1);
        data = data(2:size(data, 2));
    case {'push'}
        data = [varargin{1}, data];
    otherwise
        assert(false, ['Wrong command: ', command]);
    end
end
```

The variable `data` is the stack. The statement `coder.varsize('data', [1, varargin{1}], [0 1])` declares that:

- `data` is a row vector
- Its first dimension has a fixed size
- Its second dimension can grow to an upper bound of 32

Generate a MEX function for `test_stack`:

```
codegen -config:mex test_stack
```

`codegen` generates a MEX function in the current folder.

Run `test_stack_mex` to get these results:

```
value =
    20

value =
    19

value =
    18

value =
    17

value =
    16

value =
    15

value =
    14

value =
    13

value =
    12

value =
    11
```

At run time, the number of items in the stack grows from zero to 20, and then shrinks to 10.

Declare a Variable-Size Structure Field.

Write a function `struct_example` that declares an array `data`, where each element is a structure that contains a variable-size field:

```
function y=struct_example() %#codegen
```

```
  d = struct('values', zeros(1,0), 'color', 0);
  data = repmat(d, [3 3]);
  coder.varsize('data(:).values');

  for i = 1:numel(data)
      data(i).color = rand-0.5;
      data(i).values = 1:i;
  end

  y = 0;
  for i = 1:numel(data)
      if data(i).color > 0
          y = y + sum(data(i).values);
      end;
  end
```

The statement `coder.varsize('data(:).values')` marks as variable-size the field `values` inside each element of the matrix `data`.

Generate a MEX function for `struct_example`:

```
codegen -config:mex struct_example
```

Run `struct_example`.

Each time you run `struct_example` you get a different answer because the function loads the array with random numbers.

Make a Cell Array Variable Size

Write the function `make_varsz_cell` that defines a local cell array variable `c` whose elements have the same class, but different sizes. Use `coder.varsize` to indicate that `c` has variable size.

```
function y =  make_varsz_cell()
c = {1 [2 3]};
coder.varsize('c', [1 3], [0 1]);
y = c;
end
```

Generate a C static library.

```
codegen -config:lib make_varsz_cell -report
```

In the report, view the MATLAB variables.

`c` is a 1x:3 homogeneous cell array whose elements are 1x:2 double.

- "Generate Code for Variable-Size Data"
- "Defining Variable-Size Structure Fields"
- "Defining Variable-Size Global Data"
- "Incompatibilities with MATLAB in Variable-Size Support for Code Generation"

Limitations

- If you use the cell function to create a `cell` array, you cannot use `coder.varsize` with that cell array.
- If you use `coder.varsize` with a cell array element, the `coder.varsize` declaration must follow the first assignment to the element. For example:

  ```
  ...
  x = cell(3, 3);
  x{1} = [1 2];
  coder.varsize('x{1}');
  ...
  ```
- You cannot use `coder.varsize` with a cell array input that is heterogeneous.
- You cannot use `coder.varsize` with global variables.
- You cannot use `coder.varsize` with MATLAB class properties.

More About

Tips

- If you use input variables (or result of a computation using input variables) to specify the size of an array, it is declared as variable-size in the generated code. Do not use `coder.varsize` on the array again, unless you also want to specify an upper bound for its size.
- Using `coder.varsize` on an array without explicit upper bounds causes dynamic memory allocation of the array. This dynamic memory allocation can reduce the speed of generated code. To avoid dynamic memory allocation, use the syntax `coder.varsize('`*var*$_1$`', '`*var*$_2$`', ..., `*ubound*`)` to specify an upper bound for the array size (if you know it in advance).

- A cell array can be variable size only if it is homogeneous. When you use `coder.varsize` with a cell array, the code generation software tries to make the cell array homogeneous. It tries to find a class and size that apply to all elements of the cell array. For example, if the first element is double and the second element is 1x2 double, all elements can be represented as 1x:2 double. If the code generation software cannot find a common class and size, code generation fails. For example, suppose that the first element of a cell array is char and the second element is double. The code generation software cannot find a class that can represent both elements.
- "Homogeneous vs. Heterogeneous Cell Arrays"

See Also

`codegen` | `size` | `varargin`

Introduced in R2011a

coder.wref

Package: coder

Pass argument by reference as write-only output

Syntax

`[y =] coder.ceval('function_name', coder.wref(arg0), ... u_n);`

Arguments

`arg0`

Variable passed by reference as a *write-only* output to the external C/C++ function called in `coder.ceval`.

Description

`[y =] coder.ceval('`*`function_name`*`',` **`coder.wref(`*`arg0`*`)`**`, ...` *`u_n`*`);` passes the variable *`arg0`* by reference as a *write-only* output to the external C/C++ function called in `coder.ceval`. You add `coder.wref` inside `coder.ceval` as an argument to *`function_name`*. The argument list can contain multiple `coder.wref` constructs. Add a separate `coder.wref` construct for each write-only argument that you want to pass by reference to *`function_name`*.

Caution The generated code assumes that a variable passed by `coder.wref` is *write-only* and optimizes the code accordingly. Consequently, the C/C++ function must write to the variable. If the variable is a vector or matrix, the C/C++ function must write to *every* element of the variable. Otherwise, results are unpredictable.

Only use `coder.wref` in MATLAB code that you have compiled with `codegen`. `coder.wref` generates an error in uncompiled MATLAB code.

Examples

In the following example, a MATLAB function `fcn` has a single input `u` and a single output `y`, a 5-by-10 matrix. `fcn` calls a C function `init` to initialize the matrix, passing `y` by reference as a write-only output. Here is the MATLAB function code:

```
function y = fcn(u)
%#codegen
y = zeros(5,10);
coder.ceval('init', coder.wref(y));
```

The C function prototype for `init` must be as follows:

```
void init(double *x);
```

In this example:

- Although the C function is void, `coder.wref` allows it to access, modify, and return a matrix to the MATLAB function.
- The C function prototype defines the output as a pointer because it is passed by reference.
- For C/C++ code generation, you must set the type of the output `y` explicitly—in this case to a matrix of type `double`.
- The generated code collapses matrices to a single dimension.

See Also

`coder.ceval` | `coder.ref` | `coder.rref`

Introduced in R2011a

parfor

Parallel `for`-loop

Syntax

```
parfor LoopVar = InitVal:EndVal; Statements; end
parfor (LoopVar = InitVal:EndVal, NumThreads); Statements; end
```

Description

`parfor LoopVar = InitVal:EndVal; Statements; end` creates a loop in a generated MEX function or in C/C++ code that runs in parallel on shared-memory multicore platforms.

The `parfor`-loop executes the `Statements` for values of `LoopVar` between `InitVal` and `Endval`. `LoopVar` specifies a vector of integer values increasing by 1.

`parfor (LoopVar = InitVal:EndVal, NumThreads); Statements; end` uses a maximum of `NumThreads` threads when creating a parallel `for`-loop.

Examples

Generate MEX for `parfor`

Generate a MEX function for a `parfor`-loop to execute on the maximum number of cores available.

Write a MATLAB function, `test_parfor`, that calls the fast Fourier transform function, `fft`, in a `parfor`-loop. Because the loop iterations run in parallel, this evaluation can be completed much faster than an analogous `for`-loop.

```
function a = test_parfor %#codegen
a=ones(10,256);
r=rand(10,256);
parfor i=1:10
```

```
    a(i,:)=real(fft(r(i)));
end
```

Generate a MEX function for `test_parfor`. At the MATLAB command line, enter:

```
codegen test_parfor
```

`codegen` generates a MEX function, `test_parfor_mex`, in the current folder.

Run the MEX function. At the MATLAB command line, enter:

```
test_parfor_mex
```

The MEX function runs using the available cores.

Specify Maximum Number of Threads for `parfor`

Specify the maximum number of threads when generating a MEX function for a `parfor`-loop.

Write a MATLAB function, `specify_num_threads`, that uses input, `u`, to specify the maximum number of threads in the `parfor`-loop.

```
function y = specify_num_threads(u) %#codegen
  y = ones(1,100);
  % u specifies maximum number of threads
  parfor (i = 1:100,u)
    y(i) = i;
  end
end
```

Generate a MEX function for `specify_num_threads`. Use `-args 0` to specify the type of the input. At the MATLAB command line, enter:

```
% -args 0 specifies that input u is a scalar double
% u is typecast to an integer by the code generation software
codegen -report specify_num_threads -args 0
```

`codegen` generates a MEX function, `specify_num_threads_mex`, in the current folder.

Run the MEX function, specifying that it run in parallel on at most four threads. At the MATLAB command line, enter:

```
specify_num_threads_mex(4)
```

The generated MEX function runs on up to four cores. If fewer than four cores are available, the MEX function runs on the maximum number of cores available at the time of the call.

Generate MEX for `parfor` Without Parallelization

Disable parallelization before generating a MEX function for a `parfor`-loop.

Write a MATLAB function, `test_parfor`, that calls the fast Fourier transform function, `fft`, in a `parfor`-loop.

```
function a = test_parfor %#codegen
a=ones(10,256);
r=rand(10,256);
parfor i=1:10
    a(i,:)=real(fft(r(i)));
end
```

Generate a MEX function for `test_parfor`. Disable the use of OpenMP so that `codegen` does not generate a MEX function that can run on multiple threads.

```
codegen -O disable:OpenMP test_parfor
```

`codegen` generates a MEX function, `test_parfor_mex`, in the current folder.

Run the MEX function.

```
test_parfor_mex
```

The MEX function runs on a single thread.

If you disable parallelization, MATLAB Coder treats `parfor`-loops as `for`-loops. The software generates a MEX function that runs on a single thread. Disable parallelization to compare performance of the serial and parallel versions of the generated MEX function or C/C++ code. You can also disable parallelization to debug issues with the parallel version.

- “Generate Code with Parallel for-Loops (parfor)”

Input Arguments

`LoopVar` — Loop index
integer

Loop index variable whose initial value is `InitVal` and final value is `EndVal`.

`InitVal` — Initial value of loop index

integer

Initial value for loop index variable, `Loopvar`. With `EndVal`, specifies the `parfor` range vector, which must be of the form `M:N`.

`EndVal` — Final value of loop index

integer

Final value for loop index variable, `LoopVar`. With `InitVal`, specifies the `parfor` range vector, which must be of the form `M:N`.

`Statements` — Loop body

strings, separated by semicolon or newline

The series of MATLAB commands to execute in the `parfor`-loop.

If you put more than one statement on the same line, separate the statements with semicolons. For example:

```
parfor i=1:10
 arr(i) = rand(); arr(i) = 2*arr(i)-1;
end
```

`NumThreads` — Maximum number of threads running in parallel

number of available cores (default) | nonnegative integer

Maximum number of threads to use. If you specify the upper limit, MATLAB Coder uses no more than this number, even if additional cores are available. If you request more threads than the number of available cores, MATLAB Coder uses the maximum number of cores available at the time of the call. If the loop iterations are fewer than the threads, some threads perform no work.

If the parfor-loop cannot run on multiple threads (for example, if only one core is available or `NumThreads` is 0), MATLAB Coder executes the loop in a serial manner.

Limitations

- You must use a compiler that supports the Open Multiprocessing (OpenMP) application interface. See `http://www.mathworks.com/support/compilers/`

current_release/. If you use a compiler that does not support OpenMP, MATLAB Coder treats the parfor-loops as for-loops. In the generated MEX function or C/C++ code, the loop iterations run on a single thread.

- Do not use the following constructs inside parfor loops:
  - You cannot call extrinsic functions using coder.extrinsic in the body of a parfor-loop.
  - You cannot write to a global variable inside a parfor-loop.
  - MATLAB Coder does not support the use of coder.ceval in reductions. For example, you cannot generate code for the following parfor-loop:

    ```
    parfor i=1:4
      y=coder.ceval('myCFcn',y,i);
    end
    ```
    Instead, write a local function that calls the C code using coder.ceval and call this function in the parfor-loop. For example:

    ```
    parfor i=1:4
      y = callMyCFcn(y,i);
    end
    function y = callMyCFcn(y,i)
     y = coder.ceval('mCyFcn', y , i);
    end
    ```
  - You cannot use varargin or varargout in parfor-loops.
- The type of the loop index must be representable by an integer type on the target hardware. Use a type that does not require a multiword type in the generated code.
- parfor for standalone code generation requires the toolchain approach for building executables or libraries. Do not change settings that cause the code generation software to use the template makefile approach. See “Project or Configuration is Using the Template Makefile”.

For a comprehensive list of restrictions, see “parfor Restrictions”.

More About

Tips

- Use a parfor-loop when:

  - You need many loop iterations of a simple calculation. `parfor` divides the loop iterations into groups so that each thread can execute one group of iterations.
  - You have loop iterations that take a long time to execute.
- Do not use a `parfor`-loop when an iteration in your loop depends on the results of other iterations.

  Reductions are one exception to this rule. A *reduction variable* accumulates a value that depends on all the iterations together, but is independent of the iteration order.

- “Algorithm Acceleration Using Parallel for-Loops (parfor)”
- “Control Compilation of parfor-Loops”
- “When to Use parfor-Loops”
- “When Not to Use parfor-Loops”
- “Classification of Variables in parfor-Loops”

See Also

Functions
`codegen`

addOption

Class: coder.make.BuildConfiguration
Package: coder.make

Add new option

Syntax

`h.addOption(OptionName, buildItemHandle)`

Description

`h.addOption(OptionName, buildItemHandle)` adds an option to `coder.make.BuildConfiguration.Options`.

Tips

Before using `addOption`, create a `coder.make.BuildItem` object to use as the second argument.

Input Arguments

h — BuildConfiguration handle

object handle

BuildConfiguration handle, specified as a `coder.make.BuildConfiguration` object.

Example: `h`

`OptionName` — Name of option

new option name

Name of option, specified as a string. Choose a new option name.

Example: `'faster2'`

Data Types: `char`

`buildItemHandle` — BuildItem handle
object handle

BuildItem handle, specified as a `coder.make.BuildItem` object that contains an option value.

Example: `bi`

Examples

Using the Option-related methods interactively

```
tc = coder.make.ToolchainInfo;
cfg = tc.getBuildConfiguration('Faster Builds');
cfg.isOption('X Compiler')

ans  =

     0

bi = coder.make.BuildItem('WV','wrongvalue')

bi =

 Macro  : WV
 Value : wrongvalue

cfg.addOption('X Compiler',bi);
value = cfg.getOption('X Compiler')

value =

 Macro  : WV
 Value : wrongvalue

cfg.setOption('X Compiler','rightvalue');
value = cfg.getOption('X Compiler')

value =

 Macro  : WV
 Value : rightvalue
```

See Also

`coder.make.BuildConfiguration.getOption` | `coder.make.BuildConfiguration.isOption` | `coder.make.BuildConfiguration.setOption` | `coder.make.BuildItem`

getOption

Class: coder.make.BuildConfiguration
Package: coder.make

Get value of option

Syntax

`OptionValue = h.getOption(OptionName)`

Description

`OptionValue = h.getOption(OptionName)` returns the value and optional macro name of a build configuration option.

Input Arguments

`h` — BuildConfiguration handle

object handle

BuildConfiguration handle, specified as a `coder.make.BuildConfiguration` object.

Example: `h`

`OptionName` — Name of option

new option name

Name of option, specified as a string. Choose a new option name.

Example: `'faster2'`

Data Types: `char`

Output Arguments

`OptionValue` — Value of option

coder.make.BuildItem object

Value of the option, returned as a `coder.make.BuildItem` object that contains a value and an optional macro name.

Examples

Using the Option-related methods interactively

```
tc = coder.make.ToolchainInfo;
cfg = tc.getBuildConfiguration('Faster Builds');
cfg.isOption('X Compiler')

ans  =

     0

bi = coder.make.BuildItem('WV','wrongvalue')

bi =

 Macro  : WV
 Value : wrongvalue

cfg.addOption('X Compiler',bi);
value = cfg.getOption('X Compiler')

value =

 Macro  : WV
 Value : wrongvalue

cfg.setOption('X Compiler','rightvalue');
value = cfg.getOption('X Compiler')

value =

 Macro  : WV
 Value : rightvalue
```

See Also

`coder.make.BuildConfiguration.addOption` | `coder.make.BuildConfiguration.isOption` | `coder.make.BuildConfiguration.setOption`

info

Class: coder.make.BuildConfiguration
Package: coder.make

Get information about build configuration

Syntax

```
h.info
OutputInfo = h.info
```

Description

`h.info` displays information about the `coder.make.BuildConfiguration` object in the MATLAB Command Window.

`OutputInfo = h.info` returns information about the `coder.make.BuildConfiguration` object

Input Arguments

h — BuildConfiguration handle

object handle

BuildConfiguration handle, specified as a `coder.make.BuildConfiguration` object.

Example: `h`

Output Arguments

`OutputInfo` — Build configuration information

character string

Build configuration information, returned as a character string.

Examples

The `intel_tc.m` file from "Adding a Custom Toolchain", uses the following lines to display information about the `BuildConfiguration` property:

```
tc = intel_tc
cfg = tc.getBuildConfiguration('Faster Builds');
cfg.info
```

```
##############################################
# Build Configuration : Faster Builds
# Description         : Default settings for faster compile/link of code
##############################################

ARFLAGS              = /nologo
CFLAGS               = $(cflags) $(CVARSFLAG) $(CFLAGS_ADDITIONAL) /c /Od
CPPFLAGS             = $(cflags) $(CVARSFLAG) $(CPPFLAGS_ADDITIONAL) /c /Od
DOWNLOAD_FLAGS        =
EXECUTE_FLAGS         =
LDFLAGS              = $(ldebug) $(conflags) $(LIBS_TOOLCHAIN)
MEX_CFLAGS            =
MEX_LDFLAGS           =
MAKE_FLAGS           = -f $(MAKEFILE)
SHAREDLIB_LDFLAGS    = $(ldebug) $(conflags) $(LIBS_TOOLCHAIN) -dll -def:$(DEF_FILE)
```

isOption

Class: coder.make.BuildConfiguration
Package: coder.make

Determine if option exists

Syntax

`OutputValue = isOption(OptionName)`

Description

`OutputValue = isOption(OptionName)` returns `'1'` (true) if the specified option exists. Otherwise, it returns `'0'` (false).

Input Arguments

`h` — BuildConfiguration handle

object handle

BuildConfiguration handle, specified as a `coder.make.BuildConfiguration` object.

Example: `h`

`OptionName` — Name of option

new option name

Name of option, specified as a string. Choose a new option name.

Example: `'faster2'`

Data Types: `char`

Output Arguments

`OutputValue` — Option exists

`0 | 1`

Option exists, returned as a logical value. If the option exists, the value is `'1'` (true). Otherwise, the output is `'0'` (false).

Examples

Using the Option-related methods interactively

```
tc = coder.make.ToolchainInfo;
cfg = tc.getBuildConfiguration('Faster Builds');
cfg.isOption('X Compiler')

ans  =

     0

bi = coder.make.BuildItem('WV','wrongvalue')

bi =

 Macro  : WV
 Value : wrongvalue

cfg.addOption('X Compiler',bi);
value = cfg.getOption('X Compiler')

value =

 Macro  : WV
 Value : wrongvalue

cfg.setOption('X Compiler','rightvalue');
value = cfg.getOption('X Compiler')

value =

 Macro  : WV
 Value : rightvalue
```

See Also

`coder.make.BuildConfiguration.addOption` | `coder.make.BuildConfiguration.getOption` | `coder.make.BuildConfiguration.setOption` | `coder.make.BuildItem`

keys

Class: coder.make.BuildConfiguration
Package: coder.make

Get all option names

Syntax

`Out = h.keys`

Description

`Out = h.keys` returns a list of all option names or keys in the build configuration.

Input Arguments

`h` — BuildConfiguration handle

object handle

BuildConfiguration handle, specified as a `coder.make.BuildConfiguration` object.

Example: `h`

Output Arguments

`Output` — List of all option names or keys in build configuration

cell array of strings

List of all option names or keys in build configuration, returned as a cell array of strings.

Examples

The `intel_tc.m` file from "Adding a Custom Toolchain", uses the following lines to display keys from the `BuildConfiguration` property:

```
tc = intel_tc
cfg = tc.getBuildConfiguration('Faster Builds');
cfg.keys

ans =

  Columns 1 through 5

    'Archiver'    'C Compiler'    'C++ Compiler'    'Download'    'Execute'

  Columns 6 through 10

    'Linker'    'MEX Compiler'    'MEX Linker'    'Make Tool'    [1x21 char]
```

setOption

Class: coder.make.BuildConfiguration
Package: coder.make

Set value of option

Syntax

```
h.setOption(OptionName, OptionValue)
```

Description

`h.setOption(OptionName, OptionValue)` updates the values within a coder.make.BuildConfiguration object.

Input Arguments

`h` — BuildConfiguration handle

object handle

BuildConfiguration handle, specified as a `coder.make.BuildConfiguration` object.

Example: `h`

`OptionName` — Name of option

new option name

Name of option, specified as a string. Choose a new option name.

Example: `'faster2'`

Data Types: `char`

`OptionValue` — Value of option

string or object handle

Value of option, specified as a character string, or as the handle of a `coder.make.BuildItem` object that contains an option value.

Example: `linkerOpts`

Examples

The setOption method in intel_tc

The `intel_tc.m` file from “Adding a Custom Toolchain”, gets a default `BuildConfiguration` object and then uses `setOption` to update the values in that object:

```
% ------------------------------------------------
% BUILD CONFIGURATIONS
% ------------------------------------------------

optimsOffOpts = {'/c /Od'};
optimsOnOpts = {'/c /O2'};
cCompilerOpts    = '$(cflags) $(CVARSFLAG) $(CFLAGS_ADDITIONAL)';
cppCompilerOpts  = '$(cflags) $(CVARSFLAG) $(CPPFLAGS_ADDITIONAL)';
linkerOpts       = {'$(ldebug) $(conflags) $(LIBS_TOOLCHAIN)'};
sharedLinkerOpts = horzcat(linkerOpts,'-dll -def:$(DEF_FILE)');
archiverOpts     = {'/nologo'};

% Get the debug flag per build tool
debugFlag.CCompiler   = '$(CDEBUG)';
debugFlag.CppCompiler = '$(CPPDEBUG)';
debugFlag.Linker      = '$(LDDEBUG)';
debugFlag.Archiver    = '$(ARDEBUG)';

cfg = tc.getBuildConfiguration('Faster Builds');
cfg.setOption('C Compiler',horzcat(cCompilerOpts,optimsOffOpts));
cfg.setOption('C++ Compiler',horzcat(cppCompilerOpts,optimsOffOpts));
cfg.setOption('Linker',linkerOpts);
cfg.setOption('Shared Library Linker',sharedLinkerOpts);
cfg.setOption('Archiver',archiverOpts);

cfg = tc.getBuildConfiguration('Faster Runs');
cfg.setOption('C Compiler',horzcat(cCompilerOpts,optimsOnOpts));
cfg.setOption('C++ Compiler',horzcat(cppCompilerOpts,optimsOnOpts));
cfg.setOption('Linker',linkerOpts);
cfg.setOption('Shared Library Linker',sharedLinkerOpts);
cfg.setOption('Archiver',archiverOpts);

cfg = tc.getBuildConfiguration('Debug');
cfg.setOption('C Compiler',horzcat(cCompilerOpts,optimsOffOpts,debugFlag.CCompiler));
cfg.setOption ...
('C++ Compiler',horzcat(cppCompilerOpts,optimsOffOpts,debugFlag.CppCompiler));
cfg.setOption('Linker',horzcat(linkerOpts,debugFlag.Linker));
cfg.setOption('Shared Library Linker',horzcat(sharedLinkerOpts,debugFlag.Linker));
cfg.setOption('Archiver',horzcat(archiverOpts,debugFlag.Archiver));

tc.setBuildConfigurationOption('all','Download','');
tc.setBuildConfigurationOption('all','Execute','');
tc.setBuildConfigurationOption('all','Make Tool','-f $(MAKEFILE)');
```

Using the Option-related methods interactively

```
tc = coder.make.ToolchainInfo;
cfg = tc.getBuildConfiguration('Faster Builds');
cfg.isOption('X Compiler')

ans  =

     0

bi = coder.make.BuildItem('WV','wrongvalue')

bi =

 Macro  : WV
 Value : wrongvalue

cfg.addOption('X Compiler',bi);
value = cfg.getOption('X Compiler')

value =

 Macro  : WV
 Value : wrongvalue

cfg.setOption('X Compiler','rightvalue');
value = cfg.getOption('X Compiler')

value =

 Macro  : WV
 Value : rightvalue
```

See Also

`coder.make.BuildConfiguration.addOption` | `coder.make.BuildConfiguration.getOption` | `coder.make.BuildConfiguration.isOption` | `coder.make.BuildItem`

values

Class: coder.make.BuildConfiguration
Package: coder.make

Get all option values

Syntax

```
Out = h.values
```

Description

`Out = h.values` returns a list of all option values in the build configuration.

Input Arguments

`h` — BuildConfiguration handle
object handle

BuildConfiguration handle, specified as a `coder.make.BuildConfiguration` object.

Example: `h`

Output Arguments

`Out` — List of all option values in build configuration
string or object handle

List of all option values in the build configuration, returned as a cell array of strings.

Examples

Starting from the "Adding a Custom Toolchain" example, enter the following lines:

```
tc = intel_tc
cfg = tc.getBuildConfiguration('Faster Builds');
cfg.values

ans =

  Columns 1 through 2

    [1x1 coder.make.BuildItem]    [1x1 coder.make.BuildItem]

  Columns 3 through 4

    [1x1 coder.make.BuildItem]    [1x1 coder.make.BuildItem]

  Columns 5 through 6

    [1x1 coder.make.BuildItem]    [1x1 coder.make.BuildItem]

  Columns 7 through 8

    [1x1 coder.make.BuildItem]    [1x1 coder.make.BuildItem]

  Columns 9 through 10

    [1x1 coder.make.BuildItem]    [1x1 coder.make.BuildItem]
```

getMacro

Class: coder.make.BuildItem
Package: coder.make

Get macro name of build item

Syntax

```
h.getMacro
```

Description

`h.getMacro` returns the macro name of an existing build item.

Input Arguments

`buildItemHandle` — BuildItem handle
object handle

BuildItem handle, specified as a `coder.make.BuildItem` object that contains an option value.

Example: `bi`

Examples

```
bi = coder.make.BuildItem('bldtmvalue')
```

```
bi =

 Macro  : (empty)
 Value : bldtmvalue
```

```
bi.setMacro('BIMV2');
bi.getMacro
```

```
ans =

 BIMV2
```

See Also

`coder.make.BuildItem.getMacro` | `coder.make.BuildItem.getValue` | `coder.make.BuildItem.setMacro` | `coder.make.BuildItem.setValue`

More About

- “About coder.make.ToolchainInfo”

getValue

Class: coder.make.BuildItem
Package: coder.make

Get value of build item

Syntax

`h.getValue`

Description

`h.getValue` returns the value of an existing build item.

Input Arguments

`buildItemHandle` — BuildItem handle
object handle

BuildItem handle, specified as a `coder.make.BuildItem` object that contains an option value.

Example: `bi`

Examples

```
bi = coder.make.BuildItem('wrongvalue')
```

```
bi =

 Macro  : (empty)
 Value : wrongvalue
```

```
bi.setValue('rightvalue')
bi.getValue
```

```
ans  =

rightvalue
```

See Also

`coder.make.BuildItem.getMacro` | `coder.make.BuildItem.getValue` | `coder.make.BuildItem.setMacro` | `coder.make.BuildItem.setValue`

More About

- “About coder.make.ToolchainInfo”

setMacro

Class: coder.make.BuildItem
Package: coder.make

Set macro name of build item

Syntax

```
h.setMacro(blditm_macroname)
```

Description

`h.setMacro(blditm_macroname)` sets the macro name of an existing build item.

Input Arguments

`buildItemHandle` — BuildItem handle
object handle

BuildItem handle, specified as a `coder.make.BuildItem` object that contains an option value.

Example: `bi`

`blditm_macroname` — Macro name of build item
string

Macro name of build item, specified as a string.

Data Types: `char`

Examples

```
bi = coder.make.BuildItem('bldtmvalue')
```

```
bi =
 Macro  : (empty)
 Value : bldtmvalue

bi.setMacro('BIMV2');
bi.getMacro

ans =

 BIMV2
```

See Also

`coder.make.BuildItem.getMacro` | `coder.make.BuildItem.getValue` | `coder.make.BuildItem.setMacro` | `coder.make.BuildItem.setValue`

More About

- "About coder.make.ToolchainInfo"

setValue

Class: coder.make.BuildItem
Package: coder.make

Set value of build item

Syntax

```
h.setValue(blditm_value)
```

Description

`h.setValue(blditm_value)` sets the value of an existing build item macro.

Input Arguments

`buildItemHandle` — BuildItem handle

object handle

BuildItem handle, specified as a `coder.make.BuildItem` object that contains an option value.

Example: `bi`

`blditm_value` — Value of build item

string

Value of build item

Data Types: `char`

Examples

```
bi = coder.make.BuildItem('wrongvalue')
```

```
bi =
 Macro  : (empty)
 Value : wrongvalue

bi.setValue('rightvalue')
bi.getValue

ans  =

rightvalue
```

See Also

`coder.make.BuildItem.getMacro` | `coder.make.BuildItem.getValue` | `coder.make.BuildItem.setMacro` | `coder.make.BuildItem.setValue`

More About

- "About coder.make.ToolchainInfo"

addDirective

Class: coder.make.BuildTool
Package: coder.make

Add directive to `Directives`

Syntax

`h.addDirective(name,value)`

Description

`h.addDirective(name,value)` creates a named directive, assigns a value to it, and adds it to `coder.make.BuildTool.Directives`.

Input Arguments

h — Object handle

variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`name` — Name of directive

string

Name of directive, specified as a string.

Data Types: `char`

`value` — Value of directive

string

Value of directive, specified as a string.

Data Types: `char`

Examples

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
tool.addDirective('IncludeSearchPath','-O');
tool.setDirective('IncludeSearchPath','-I');
tool.getDirective('IncludeSearchPath')
```

```
ans  =

-I
```

See Also

“Properties” on page 3-128 | `coder.make.BuildTool.getDirective` | `coder.make.BuildTool.setDirective`

addFileExtension

Class: coder.make.BuildTool
Package: coder.make

Add new file extension entry to `FileExtensions`

Syntax

`h.addFileExtension(name,buildItemHandle)`

Description

`h.addFileExtension(name,buildItemHandle)` creates a named extension, assigns a `coder.make.BuildItem` object to it, and adds it to `coder.make.BuildTool.FileExtensions`.

Input Arguments

h — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`name` — Name of file type.
string

Name of file type, specified as a string.

Data Types: `char`

`buildItemHandle` — BuildItem handle
object handle

BuildItem handle, specified as a `coder.make.BuildItem` object that contains an option value.

Example: `bi`

Examples

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
blditm = coder.make.BuildItem('CD','.cd')

bldtm =

 Macro  : CD
 Value : .cd

tool.addFileExtension('SourceX',blditm)
value = tool.getFileExtension('SourceX')

value  =

.cd

tool.setFileExtension('SourceX','.ef')
value = tool.getFileExtension('SourceX')

value  =

.ef
```

See Also

"Properties" on page 3-128 | `coder.make.BuildTool.getFileExtension` | `coder.make.BuildTool.setFileExtension`

getCommand

Class: coder.make.BuildTool
Package: coder.make

Get build tool command

Syntax

```
c_out = h.getCommand
c_out = h.getCommand('value')
c_out = h.getCommand('macro')
```

Description

`c_out = h.getCommand` returns the value of the `coder.make.BuildTool.Command` property.

`c_out = h.getCommand('value')` also returns the value of `coder.make.BuildTool.Command`.

`c_out = h.getCommand('macro')` returns the macro name of `coder.make.BuildTool.Command`.

Input Arguments

h — Object handle

variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`'value'` — Get command value

Gets the command value.

`'macro'`

Gets the command macro.

Output Arguments

`c_out` — Command value or macro

The command value or macro of the build tool, returned as a scalar.

Data Types: `char`

Examples

```
tc = coder.make.ToolchainInfo;
btl = tc.getBuildTool('C Compiler');
btl.getCommand

ans  =

icl

btl.getCommand('value')

ans  =

icl

c_out = btl.getCommand('macro')

c_out  =

CC
```

See Also

`coder.make.BuildTool.setCommand`

getDirective

Class: coder.make.BuildTool
Package: coder.make

Get value of named directive from `Directives`

Syntax

```
value = h.getDirective(name)
```

Description

`value = h.getDirective(name)` gets the value of the named directive from `Directives`

Input Arguments

`h` — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`name` — Name of directive
string

Name of directive, specified as a string.

Data Types: `char`

Output Arguments

`value` — Value of directive
string

Value of directive, specified as a string.

Data Types: `char`

Examples

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
tool.addDirective('IncludeSearchPath','-O');
tool.setDirective('IncludeSearchPath','-I');
tool.getDirective('IncludeSearchPath')
```

```
ans  =

-I
```

See Also

“Properties” on page 3-128 | `coder.make.BuildTool.addDirective` | `coder.make.BuildTool.setDirective`

getFileExtension

Class: coder.make.BuildTool
Package: coder.make

Get file extension for named file type in `FileExtensions`

Syntax

```
value = h.getFileExtension(name)
```

Description

`value = h.getFileExtension(name)` gets the file extension of the named file type from `coder.make.BuildTool.FileExtensions`.

Input Arguments

`h` — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`name` — Name of file type.
string

Name of file type, specified as a string.

Data Types: `char`

Output Arguments

`value` — Value of file extension
string

Value of file extension, specified as a string.

Data Types: `char`

Examples

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
blditm = coder.make.BuildItem('CD','.cd')

bldtm =

 Macro  : CD
 Value : .cd

tool.addFileExtension('SourceX',blditm)
value = tool.getFileExtension('SourceX')

value  =

.cd

tool.setFileExtension('SourceX','.ef')
value = tool.getFileExtension('SourceX')

value  =

.ef
```

See Also

"Properties" on page 3-128 | `coder.make.BuildTool.addFileExtension` | `coder.make.BuildTool.setFileExtension`

getName

Class: coder.make.BuildTool
Package: coder.make

Get build tool name

Syntax

```
toolname = h.getName
```

Description

`toolname = h.getName` returns the name of the `coder.make.BuildTool` object.

Input Arguments

`h` — Object handle

variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

Output Arguments

`toolname` — Name of BuildTool object

The name of the `coder.make.BuildTool` object

Examples

Using the getName and setName methods interactively

Starting from the “Adding a Custom Toolchain” example, enter the following lines:

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
tool.getName

ans  =

C Compiler

tool.setName('X Compiler')
tool.getName

ans  =

X Compiler
```

See Also

`coder.make.BuildTool.setName`

getPath

Class: coder.make.BuildTool
Package: coder.make

Get path and macro of build tool in `Path`

Syntax

```
btpath = h.getPath
btmacro = h.getPath('macro')
```

Description

`btpath = h.getPath` returns the path of the build tool from **coder.make.BuildTool.Paths**.

`btmacro = h.getPath('macro')` returns the macro for the path of the build tool from **coder.make.BuildTool.Paths**

Tips

If the system command environment specifies a path variable for the build tool, the value of the path does not need to be specified by the `BuildTool` object.

Input Arguments

h — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

Output Arguments

`btpath` — Path of build tool object

The path of `BuildTool` object, returned as a scalar.

Data Types: `char`

`btmacro` — Macro for path of build tool object

Macro for path of `BuildTool` object, returned as a scalar.

Data Types: `char`

Examples

Enter the following lines:

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
tool.getPath

ans  =

     ''

tool.getPath('macro')

ans  =

CC_PATH

tool.setPath('/gcc')
tool.Path

ans =

 Macro  : CC_PATH
 Value : /gcc
```

See Also

“Properties” on page 3-128 | `coder.make.BuildTool.setPath`

info

Class: coder.make.BuildTool
Package: coder.make

Display build tool properties and values

Syntax

`h.info`

Description

`h.info` returns information about the `coder.make.BuildTool` object.

Input Arguments

h — Object handle

variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

Examples

Starting from the “Adding a Custom Toolchain” example, enter the following lines:

```
tc = intel_tc;
tool = tc.getBuildTool('C Compiler');
tool.info
```

```
##############################################
# Build Tool: Intel C Compiler
##############################################

Language              : 'C'
OptionsRegistry       : {'C Compiler','CFLAGS'}
InputFileExtensions   : {'Source'}
OutputFileExtensions  : {'Object'}
```

```
DerivedFileExtensions : {'|>OBJ_EXT<|'}
SupportedOutputs      : {'*'}
CommandPattern        : '|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|'

# ---------
# Command
# ---------
CC = icl
CC_PATH  =

# ------------
# Directives
# ------------
Debug              = -Zi
Include            =
IncludeSearchPath  = -I
OutputFlag         = -Fo
PreprocessorDefine = -D

# -----------------
# File Extensions
# -----------------
Header = .h
Object = .obj
Source = .c
```

setCommandPattern

Class: coder.make.BuildTool
Package: coder.make

Set pattern of commands for build tools

Syntax

`h.setCommandPattern(commandpattern);`

Description

`h.setCommandPattern(commandpattern);` sets the command pattern of a specific `coder.make.BuildTool` object in `coder.make.ToolchainInfo.BuildTools`.

Input Arguments

h — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`commandpattern` — Pattern of commands and options
string

Pattern of commands and options that a `BuildTool` can use to run a build tool, specified as a string.

Use `|>` and `<|` as the left and right delimiters of a command element. Use a space character between the `<|` and `|>` delimiters to require a space between two command elements. For example:

- `|>TOOL<| |>TOOL_OPTIONS<|` requires a space between the two command elements.

- `|>OUTPUT_FLAG<||>OUTPUT<|` requires no space between the two command elements.

Data Types: `char`

Examples

The `intel_tc.m` file from “Adding a Custom Toolchain”, uses the following lines to get and update one of the `BuildTool` objects, including the command pattern:

```
% -----------------------------
% C Compiler
% -----------------------------

tool = tc.getBuildTool('C Compiler');

tool.setName('Intel C Compiler');
tool.setCommand('icl');
tool.setPath('');

tool.setDirective('IncludeSearchPath','-I');
tool.setDirective('PreprocessorDefine','-D');
tool.setDirective('OutputFlag','-Fo');
tool.setDirective('Debug','-Zi');

tool.setFileExtension('Source','.c');
tool.setFileExtension('Header','.h');
tool.setFileExtension('Object','.obj');

tool.setCommandPattern('|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|');
```

See Also

`coder.make.ToolchainInfo.addBuildTool` | `coder.make.BuildTool.setCommandPattern`

setCommand

Class: coder.make.BuildTool
Package: coder.make

Set build tool command

Syntax

```
h.setCommand(commandvalueinput)
```

Description

`h.setCommand(commandvalueinput)` sets the value of the `coder.make.BuildTool.Command` property.

Input Arguments

h — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`commandvalueinput` — Value of coder.make.BuildTool.Command property

Value of the `coder.make.BuildTool.Command` property. Enter a character string, or the handle of a `coder.make.BuildItem` object that contains an option value.

Examples

Get a default build tool and set its properties

The `intel_tc.m` file from "Adding a Custom Toolchain", uses the following lines to set the command of a default build tool, `C Compiler`, from a `ToolchainInfo` object called `tc`, and then sets its properties.

```
% ------------------------------
% C Compiler
% ------------------------------

tool = tc.getBuildTool('C Compiler');

tool.setName('Intel C Compiler');
tool.setCommand('icl');
tool.setPath('');

tool.setDirective('IncludeSearchPath','-I');
tool.setDirective('PreprocessorDefine','-D');
tool.setDirective('OutputFlag','-Fo');
tool.setDirective('Debug','-Zi');

tool.setFileExtension('Source','.c');
tool.setFileExtension('Header','.h');
tool.setFileExtension('Object','.obj');

tool.setCommandPattern('|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|');
```

See Also

`coder.make.BuildTool.getCommand`

setDirective

Class: coder.make.BuildTool
Package: coder.make

Set value of directive in `Directives`

Syntax

```
h.setDirective(name,value)
```

Description

`h.setDirective(name,value)` assigns a value to the named directive in `coder.make.Directives`.

Input Arguments

h — Object handle

variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`name` — Name of directive

string

Name of directive, specified as a string.

Data Types: `char`

`value` — Value of directive

string

Value of directive, specified as a string.

Data Types: `char`

Examples

Get a default build tool and set its properties

The following example code shows `setDirective` in a portion of the `intel_tc.m` file from the “Adding a Custom Toolchain” tutorial.

```
% ------------------------------
% C Compiler
% ------------------------------

tool = tc.getBuildTool('C Compiler');

tool.setName('Intel C Compiler');
tool.setCommand('icl');
tool.setPath('');

tool.setDirective('IncludeSearchPath','-I');
tool.setDirective('PreprocessorDefine','-D');
tool.setDirective('OutputFlag','-Fo');
tool.setDirective('Debug','-Zi');

tool.setFileExtension('Source','.c');
tool.setFileExtension('Header','.h');
tool.setFileExtension('Object','.obj');

tool.setCommandPattern('|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|');
```

Use the setDirective method interactively

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
tool.addDirective('IncludeSearchPath','-O');
tool.setDirective('IncludeSearchPath','-I');
tool.getDirective('IncludeSearchPath')

ans  =

-I
```

See Also

“Properties” on page 3-128 | `coder.make.BuildTool.addDirective` | `coder.make.BuildTool.getDirective`

setFileExtension

Class: coder.make.BuildTool
Package: coder.make

Set file extension for named file type in `FileExtensions`

Syntax

```
h.setFileExtension(name,value)
```

Description

`h.setFileExtension(name,value)` sets the extension value of the named file type in `coder.make.BuildTool.FileExtensions`.

Input Arguments

h — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`name` — Name of file type.
string

Name of file type, specified as a string.

Data Types: `char`

`value` — Value of file extension
string

Value of file extension, specified as a string.

Data Types: `char`

Examples

Get a default build tool and set its properties

The following example code shows `setFileExtension` in a portion of the `intel_tc.m` file from the "Adding a Custom Toolchain" tutorial.

```
% ------------------------------
% C Compiler
% ------------------------------

tool = tc.getBuildTool('C Compiler');

tool.setName('Intel C Compiler');
tool.setCommand('icl');
tool.setPath('');

tool.setDirective('IncludeSearchPath','-I');
tool.setDirective('PreprocessorDefine','-D');
tool.setDirective('OutputFlag','-Fo');
tool.setDirective('Debug','-Zi');

tool.setFileExtension('Source','.c');
tool.setFileExtension('Header','.h');
tool.setFileExtension('Object','.obj');

tool.setCommandPattern('|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|');
```

Use the setFileExtension interactively

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
blditm = coder.make.BuildItem('CD','.cd')

bldtm =

 Macro  : CD
 Value : .cd

tool.addFileExtension('SourceX',blditm)
value = tool.getFileExtension('SourceX')

value  =

.cd

tool.setFileExtension('SourceX','.ef')
value = tool.getFileExtension('SourceX')

value  =
.ef
```

See Also

"Properties" on page 3-128 | `coder.make.BuildTool.addFileExtension` | `coder.make.BuildTool.getFileExtension`

setName

Class: coder.make.BuildTool
Package: coder.make

Set build tool name

Syntax

`h.setName(name)`

Description

`h.setName(name)` sets the name of the `coder.make.BuildTool.Name` property.

Input Arguments

`h` — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`name` — Name of build tool
string

The name of the build tool, specified as a string.

Example: `'Intel C Compiler'`

Data Types: `char`

Examples

Get a default build tool and set its properties

The following example code shows `setName` in a portion of the `intel_tc.m` file from the “Adding a Custom Toolchain” tutorial:

```
% ------------------------------
% C Compiler
% ------------------------------

tool = tc.getBuildTool('C Compiler');

tool.setName('Intel C Compiler');
tool.setCommand('icl');
tool.setPath('');

tool.setDirective('IncludeSearchPath','-I');
tool.setDirective('PreprocessorDefine','-D');
tool.setDirective('OutputFlag','-Fo');
tool.setDirective('Debug','-Zi');

tool.setFileExtension('Source','.c');
tool.setFileExtension('Header','.h');
tool.setFileExtension('Object','.obj');

tool.setCommandPattern('|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|');
```

Using the getName and setName methods interactively

Starting from the “Adding a Custom Toolchain” example, enter the following lines:

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
tool.getName

ans  =

C Compiler

tool.setName('X Compiler')
tool.getName

ans  =

X Compiler
```

setPath

Class: coder.make.BuildTool
Package: coder.make

Set path and macro of build tool in `Path`

Syntax

```
h.setPath(btpath,btmacro)
```

Description

`h.setPath(btpath,btmacro)` sets the path and macro of the build tool in **coder.make.BuildTool.Paths**.

Input Arguments

`h` — Object handle

variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

`btpath` — Path of build tool object

The path of `BuildTool` object, returned as a scalar.

Data Types: `char`

`btmacro` — Macro for path of build tool object

Macro for path of `BuildTool` object, returned as a scalar.

Data Types: `char`

Examples

Get a default build tool and set its properties

The following example code shows `setPath` in a portion of the `intel_tc.m` file from the “Adding a Custom Toolchain” tutorial.

```
% ------------------------------
% C Compiler
% ------------------------------

tool = tc.getBuildTool('C Compiler');

tool.setName('Intel C Compiler');
tool.setCommand('icl');
tool.setPath('');

tool.setDirective('IncludeSearchPath','-I');
tool.setDirective('PreprocessorDefine','-D');
tool.setDirective('OutputFlag','-Fo');
tool.setDirective('Debug','-Zi');

tool.setFileExtension('Source','.c');
tool.setFileExtension('Header','.h');
tool.setFileExtension('Object','.obj');

tool.setCommandPattern('|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|');
```

Use the getPath and setPath methods interactively

This example shows example inputs and outputs for the methods in a MATLAB Command Window:

Enter the following lines:

```
tc = coder.make.ToolchainInfo;
tool = tc.getBuildTool('C Compiler');
tool.getPath

ans  =

     ''

tool.getPath('macro')

ans  =

CC_PATH
```

```
tool.setPath('/gcc')
tool.Path

ans =

 Macro  : CC_PATH
 Value : /gcc
```

See Also

"Properties" on page 3-128 | `coder.make.BuildTool.getPath`

validate

Class: coder.make.BuildTool
Package: coder.make

Validate build tool properties

Syntax

`validtool = h.validate`

Description

`validtool = h.validate` validates the `coder.make.BuildTool` object, and generates errors if any properties are incorrectly defined.

Input Arguments

h — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

Output Arguments

`validtool` — Validity of coder.make.BuildTool object

The validity of the `coder.make.BuildTool` object. If the method detects a problem it returns `'0'` or an error message.

Examples

The `coder.make.BuildTool.validate` method returns warning and error messages if you try to validate a build tool before you have installed the build tool software (compiler, linker, archiver).

Starting from the “Adding a Custom Toolchain” example, enter the following lines:

```
tc = intel_tc;
tool = tc.getBuildTool('C Compiler');
tool.validate
```

If your host computer does not have the Intel® toolchain installed, `validate` displays the following messages:

```
Warning: Validation of build tool 'Intel C Compiler' may require the toolchain
to be set up first. The setup information is registered in the toolchain
this build tool belong to. Pass the parent ToolchainInfo object to VALIDATE
in order for any toolchain setup to be done before validation.
> In C:\Program Files\MATLAB\R2013a\toolbox\coder\foundation\build\+coder\+make\
BuildTool.p>BuildTool.checkForPresence at 634
  In C:\Program Files\MATLAB\R2013a\toolbox\coder\foundation\build\+coder\+make\
BuildTool.p>BuildTool.validate at 430
Error using message
In 'CoderFoundation:toolchain:ValidateBuildToolError',data type supplied is
incorrect for parameter {1}.

Error in C:\Program
Files\MATLAB\R2013a\toolbox\coder\foundation\build\+coder\+make\
BuildTool.p>BuildTool.checkForPresence
(line 664)


Error in C:\Program
Files\MATLAB\R2013a\toolbox\coder\foundation\build\+coder\+make\
BuildTool.p>BuildTool.validate
(line 430)


Trial>>
```

For more information, see “Troubleshooting Custom Toolchain Validation”.

See Also

`coder.make.ToolchainInfo.validate`

addAttribute

Class: coder.make.ToolchainInfo
Package: coder.make

Add custom attribute to `Attributes`

Syntax

```
h.addAttribute(att_name, att_value)
h.addAttribute(att_name)
```

Description

`h.addAttribute(att_name, att_value)` adds a custom attribute with the specified name to `coder.make.ToolchainInfo.Attributes`. Use `att_value` to override the default attribute value, `true`.

`h.addAttribute(att_name)` adds an attribute and initializes its value to `true`.

All attributes are optional. You can add attributes for the toolchain to use. The following attributes are used during the build process:

- `TransformPathsWithSpaces` (value = True/False) When enabled, this method looks for spaces in paths to source files, include files, include paths, additional source paths, object paths, and prebuild object paths, library paths, and within MACROS used in any of the stated paths. If any path contains spaces, an alternate version of the path is returned. For long path names or paths with spaces, this returns the '~' version on Windows. On UNIX platforms, paths with spaces are returned with the spaces escaped.
- `RequiresBatchFile`: (value = True/False) When enabled, creates a batch file that runs the make file that is generated.
- `SupportsUNCPaths`: (value = True/False) Looks in the same locations for UNC paths (Windows only, ignored on Linux/Mac platforms). If there is a drive mapped to the UNC the path is pointing to, then paths that are UNC paths will have a mapped drive letter put in place.

- `SupportsDoubleQuotes`: (not defined or value = True) Wraps each path in double quotes if they contain spaces.
- `RequiresCommandFile`: (not defined or value = True) This is used to handle long archiver/linker lines in Windows. If specified the make file replace a long object list with a call to a command file.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`att_name` — Name of attribute
string

Name of attribute, specified as a string of alphanumeric characters.

Data Types: `char`

`att_value` — Value of attribute
true (default)

Attribute value. Any data type.

Examples

Add an attribute and initialize its value, overriding the default value

```
h.Attribute
```

```
ans =


# -------------------
# "Attribute" List
# -------------------
(empty)
```

```
h.addAttribute('TransformPathsWithSpaces',false)
```

```
h.getAttribute('TransformPathsWithSpaces')

ans  =

     0
```

Add attribute without overriding its default value

```
h.addAttribute('CustomAttribute')
h.Attributes

ans =


# -------------------
# "Attributes" List
# -------------------
CustomAttribute = true
```

Add attribute using toolchain definition file

The `intel_tc.m` file from the “Adding a Custom Toolchain” example defines the following custom attributes:

```
tc.addAttribute('TransformPathsWithSpaces');
tc.addAttribute('RequiresCommandFile');
tc.addAttribute('RequiresBatchFile');
```

To see the property values from that example in the MATLAB Command Window, enter:

```
h = intel_tc;
h.Attributes


ans =


# -------------------
# "Attributes" List
# -------------------
RequiresBatchFile        = true
RequiresCommandFile      = true
TransformPathsWithSpaces = true
```

See Also

`coder.make.ToolchainInfo.addAttribute` | `coder.make.ToolchainInfo.getAttribute` | `coder.make.ToolchainInfo.getAttributes` | `coder.make.ToolchainInfo.isAttribute` | `coder.make.ToolchainInfo.removeAttribute`

More About

- "About coder.make.ToolchainInfo"

addBuildConfiguration

Class: coder.make.ToolchainInfo
Package: coder.make

Add build configuration

Syntax

```
h.addBuildConfiguration(bldcfg_name)
h.addBuildConfiguration(bldcfg_name, bldcfg_desc)
h.addBuildConfiguration(bldcfg_handle)
```

Description

`h.addBuildConfiguration(bldcfg_name)` creates a `coder.make.BuildConfiguration` object, assigns the value of `bldcfg_name` to Name property of the object, and adds the object to coder.make.ToolchainInfo.BuildConfigurations.

`h.addBuildConfiguration(bldcfg_name, bldcfg_desc)` assigns the value of `bldcfg_desc` to Description property of the object.

`h.addBuildConfiguration(bldcfg_handle)` adds an existing build configuration object to coder.make.ToolchainInfo.BuildConfigurations. The build configuration must have a name that is unique within coder.make.ToolchainInfo.BuildConfigurations.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldcfg_name` — Build configuration name

string

Build configuration name, specified as a string.

Data Types: `char`

`bldcfg_handle` — BuildConfiguration object handle

Handle of `coder.make.BuildConfiguration` object

`bldcfg_desc` — Build configuration description
string

Build configuration description, specified as a string.

Data Types: `char`

Examples

```
h.getBuildConfigurations


ans = 

    'Faster Builds'
    'Faster Runs'
    'Debug'

bldcfg_handle = h.getBuildConfiguration('Debug')

bldcfg_handle = 

##############################################
# Build Configuration : Debug
# Description         : Default debug settings for compiling/linking code
##############################################

ARFLAGS            = /nologo $(ARDEBUG)
CFLAGS             = $(cflags) $(CVARSFLAG) $(CFLAGS_ADDITIONAL) /c /Od $(CDEBUG)
CPPFLAGS           = $(cflags) $(CVARSFLAG) $(CPPFLAGS_ADDITIONAL) /c /Od $(CPPDEBUG)
DOWNLOAD_FLAGS     = 
EXECUTE_FLAGS      = 
LDFLAGS            = $(ldebug) $(conflags) $(LIBS_TOOLCHAIN) $(LDDEBUG)
MEX_CFLAGS         = 
MEX_LDFLAGS        = 
MAKE_FLAGS         = -f $(MAKEFILE)
SHAREDLIB_LDFLAGS  = $(ldebug) $(conflags) $(LIBS_TOOLCHAIN) -dll -def:$(DEF_FILE) $(LDDEBUG)

h.addBuildConfiguration('Debug2','Variant debugging configuration')
h.setBuildConfiguration('Debug2',bldcfg_handle)
h.getBuildConfigurations
```

```
ans =

    'Faster Builds'
    'Faster Runs'
    'Debug'
    'Debug2'
```

See Also

`coder.make.BuildConfiguration` | `coder.make.BuildItem` | `coder.make.BuildTool`

More About

- "About coder.make.ToolchainInfo"

addBuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Add `BuildTool` object to `BuildTools`

Syntax

```
tool = h.addBuildTool(bldtl_name)
tool = h.addBuildTool(bldtl_name, bldtl_handle)
```

Description

`tool = h.addBuildTool(bldtl_name)` creates and adds a named `BuildTool` object to `coder.make.ToolchainInfo.BuildTools`.

`tool = h.addBuildTool(bldtl_name, bldtl_handle)` adds an existing `BuildTool` object to `coder.make.ToolchainInfo.BuildTools`. The `bldtl_name` argument overrides the `Name` property of the existing `BuildTool` object.

Tips

Refer to the “Example” on page 3-130 for `coder.make.BuildTool` for an example of how to create a `BuildTool` object.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Output Arguments

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

Refer to the coder.make.BuildTool “Example” on page 3-130 for a complete example of how to create a `addBuildTool`.

Create a build tool and specify its name

```
h.addBuildTool('ExampleBuildTool')
```

```
ans =

##############################################
# Build Tool: Build Tool
##############################################

Language              : 'C'
OptionsRegistry       : {}
InputFileExtensions   : {}
OutputFileExtensions  : {}
DerivedFileExtensions : {}
SupportedOutputs      : {'*'}
CommandPattern        : '|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<| |>OUTPUT<|'

# ---------
# Command
# ---------

# ------------
# Directives
# ------------
(none)

# -----------------
# File Extensions
# -----------------
(none)
```

See Also

`coder.make.BuildTool` | `coder.make.ToolchainInfo.addBuildTool` | `coder.make.ToolchainInfo.getBuildTool` | `coder.make.ToolchainInfo.removeBuildTool` | `coder.make.ToolchainInfo.setBuildTool`

More About

- "About coder.make.ToolchainInfo"

addIntrinsicMacros

Class: coder.make.ToolchainInfo
Package: coder.make

Add intrinsic macro to `Macros`

Syntax

```
h.addIntrinsicMacros(intrnsc_macroname)
```

Description

`h.addIntrinsicMacros(intrnsc_macroname)` adds an intrinsic macro to `Macros`. The value of the intrinsic macro is defined by a build tool, not by ToolchainInfo or your MathWorks software.

Tips

The value of intrinsic macros are intentionally not declared in `ToolchainInfo`. The value of the intrinsic macro is defined by the build tools in the toolchain, outside the scope of your MathWorks software.

During the software build process, your MathWorks software inserts intrinsic macros into a build artifact, such as a makefile, without altering their form. During the build process, the build artifact passes the intrinsic macros to the build tools in the toolchain. The build tools interpret the macros based on their own internal definitions.

The `validate` method does not validate the intrinsic macros.

Because intrinsic macros have undeclared values, they remain unchanged in the generated code, where they can be used and interpreted by the software build toolchain. In contrast, ordinary macros are replaced by their assigned values when you create them.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`intrnsc_macronames` — Intrinsic macro name or names

Intrinsic macro name or names, specified as a string or cell array of strings.

Examples

```
h.addIntrinsicMacros('GCCROOT')
h.getMacro('GCCROOT')


ans  =

     []


h.removeIntrinsicMacros('GCCROOT')
h.getMacro('GCCROOT')
```

See Also

`coder.make.ToolchainInfo.addMacro` | `coder.make.ToolchainInfo.getMacro` | `coder.make.ToolchainInfo.removeMacro` | `coder.make.ToolchainInfo.setMacro` | `coder.make.ToolchainInfo.addIntrinsicMacros` | `coder.make.ToolchainInfo.removeIntrinsicMacros`

More About

- “About coder.make.ToolchainInfo”

addMacro

Class: coder.make.ToolchainInfo
Package: coder.make

Add macro to `Macros`

Syntax

```
h.addMacro(macroname)
h.addMacro(macroname, macrovalue)
```

Description

`h.addMacro(macroname)` adds a macro to `coder.make.ToolchainInfo.Macros` without initializing the value of the Macro.

`h.addMacro(macroname, macrovalue)` adds a macro and initializes the value of the macro.

Tips

Use `setMacro` to update the value of a macro in `coder.make.ToolchainInfo.Macros`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`macroname` — Name of macro

Name of macro.

`macrovalue` — Value of macro
string | cell

Value of the macro, specified as a string or cell array.

If the value contains MATLAB functions or other macros, ToolchainInfo interprets the value of functions and macros.

Data Types: `cell` | `char`

Examples

```
h.setMacro('CYGWIN','C:\cygwin\');
h.getMacro('CYGWIN')


ans  =

C:\cygwin\bin\


h.removeMacro('CYGWIN')
```

See Also

`coder.make.ToolchainInfo.addMacro` | `coder.make.ToolchainInfo.getMacro` | `coder.make.ToolchainInfo.removeMacro` | `coder.make.ToolchainInfo.setMacro` | `coder.make.ToolchainInfo.addIntrinsicMacros` | `coder.make.ToolchainInfo.removeIntrinsicMacros`

More About

- “About coder.make.ToolchainInfo”

addPostbuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Add postbuild tool to `PostbuildTools`

Syntax

```
h.addPostbuildTool(bldtl_name)
h.addPostbuildTool(bldtl_name, bldtl_handle)
```

Description

`h.addPostbuildTool(bldtl_name)` adds a `BuildTool` object to `PostbuildTools`.

`h.addPostbuildTool(bldtl_name, bldtl_handle)` adds a postbuild tool to `PostbuildTools` and assigns a `BuildTool` object to it.

Tips

Refer to the “Example” on page 3-130 for `coder.make.BuildTool` for an example of how to create a `BuildTool` object.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name
string

Build tool name, specified as a string.

Data Types: `char`

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

```
h = coder.make.ToolchainInfo;
bt = coder.make.BuildTool('postbuildtoolname');
h.addPostbuildTool('examplename',bt)
```

```
ans =

##############################################
# Build Tool: postbuildtoolname
##############################################

Language              : 'C'
OptionsRegistry       : {}
InputFileExtensions   : {}
OutputFileExtensions  : {}
DerivedFileExtensions : {}
SupportedOutputs      : {'*'}
CommandPattern        : '|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<| |>OUTPUT<|'

# ---------
# Command
# ---------

# ------------
# Directives
# ------------
(none)

# -----------------
# File Extensions
# -----------------
(none)
```

See Also

`coder.make.ToolchainInfo.addPostbuildTool` |
`coder.make.ToolchainInfo.getPostbuildTool` |
`coder.make.ToolchainInfo.removePostbuildTool`

| `coder.make.ToolchainInfo.setPostbuildTool` | `coder.make.ToolchainInfo.addPostDownloadTool` | `coder.make.ToolchainInfo.addPostExecuteTool`

More About

- "About coder.make.ToolchainInfo"

addPostDownloadTool

Class: coder.make.ToolchainInfo
Package: coder.make

Add post-download tool to `PostDownloadTool`

Syntax

```
h.addPostDownloadTool(bldtl_name,bldtl_handle)
```

Description

`h.addPostDownloadTool(bldtl_name,bldtl_handle)` adds a `BuildTool` object between the download tool and the execute tool specified by the `PostbuildTools` property.

Tips

Refer to the “Example” on page 3-130 for `coder.make.BuildTool` for an example of how to create a `BuildTool` object.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

```
h = coder.make.ToolchainInfo;
bt = coder.make.BuildTool('toolname');
h.addPostDownloadTool('examplename',bt)

ans =

##############################################
# Build Tool: toolname
##############################################

Language              : 'C'
OptionsRegistry       : {}
InputFileExtensions   : {}
OutputFileExtensions  : {}
DerivedFileExtensions : {}
SupportedOutputs      : {'*'}
CommandPattern        : '|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<| |>OUTPUT<|'

# ---------
# Command
# ---------

# ------------
# Directives
# ------------
(none)

# -----------------
# File Extensions
# -----------------
(none)
```

References

"About coder.make.ToolchainInfo"

See Also

`coder.make.ToolchainInfo.addPostbuildTool` | `coder.make.ToolchainInfo.getPostbuildTool` | `coder.make.ToolchainInfo.removePostbuildTool` | `coder.make.ToolchainInfo.setPostbuildTool` | `coder.make.ToolchainInfo.addPostDownloadTool` | `coder.make.ToolchainInfo.addPostExecuteTool`

More About

- "About coder.make.ToolchainInfo"

addPostExecuteTool

Class: coder.make.ToolchainInfo
Package: coder.make

Add post-execute tool to `PostbuildTools`

Syntax

```
h.addPostExecuteTool(name,bldtl_handle)
```

Description

`h.addPostExecuteTool(name,bldtl_handle)` adds a named build tool to `PostbuildTools` after the `Execute` tool.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`name` — Name of post execute tool

Name of post execute tool, specified as a string.

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

Refer to the coder.make.BuildTool “Example” on page 3-130 for an example of to create a `BuildTool`.

To use addPostExecuteTool, enter the following commands:

```
h = coder.make.ToolchainInfo;
bt = coder.make.BuildTool('toolname');
h.addPostExecuteTool('ExampleName',bt)

ans =

##############################################
# Build Tool: toolname
##############################################

Language              : 'C'
OptionsRegistry       : {}
InputFileExtensions   : {}
OutputFileExtensions  : {}
DerivedFileExtensions : {}
SupportedOutputs      : {'*'}
CommandPattern        : '|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<| |>OUTPUT<|'

# ---------
# Command
# ---------

# ------------
# Directives
# ------------
(none)

# -----------------
# File Extensions
# -----------------
(none)
```

See Also

coder.make.ToolchainInfo.addPostbuildTool | coder.make.ToolchainInfo.addPostDownloadTool

More About

- "About coder.make.ToolchainInfo"

addPrebuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Add prebuild tool to `PrebuildTools`

Syntax

```
h.addPrebuildTool(bldtl_name)
h.addPrebuildTool(bldtl_name, bldtl_handle)
```

Description

`h.addPrebuildTool(bldtl_name)` creates a `BuildTool` object and adds it to the `PrebuildTools` property.

`h.addPrebuildTool(bldtl_name, bldtl_handle)` adds an existing `BuildTool` object to the `PrebuildTools` property.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

See Also

`coder.make.ToolchainInfo.addPrebuildTool` | `coder.make.ToolchainInfo.getPrebuildTool` | `coder.make.ToolchainInfo.removePrebuildTool` | `coder.make.ToolchainInfo.setPrebuildTool`

Related Examples

- "Adding a Custom Toolchain"

More About

- "About coder.make.ToolchainInfo"

cleanup

Class: coder.make.ToolchainInfo
Package: coder.make

Run cleanup commands

Syntax

`h.cleanup`

Description

`h.cleanup` runs cleanup commands after completing the software build process. First, it runs the commands specified by `coder.make.ToolchainInfo.ShellCleanup`, and then it runs the commands specified by `coder.make.ToolchainInfo.MATLABCleanup`.

The commands in `ShellCleanup` run as system calls to the standard input of the operating system on your host computer. These commands are similar to what you enter when you use the command line.

The commands in `MATLABCleanup` run in your MATLAB software.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

Output Arguments

`success` — Indication whether cleanup completed

Indication whether cleanup completed (`0` = false, `1` = true), returned as a scalar.

Data Types: `double`

`report` — Information generated by the cleanup commands

Detailed information generated by the cleanup commands, returned as a string.

Data Types: `double`

Examples

```
[success,report] = h.cleanup

success  =

     1

report  =

     ''
```

See Also

`coder.make.ToolchainInfo.setup` | `coder.make.ToolchainInfo.validate`

More About

- “About coder.make.ToolchainInfo”

getAttribute

Class: coder.make.ToolchainInfo
Package: coder.make

Get value of attribute

Syntax

```
att_value = h.getAttribute(att_name)
```

Description

`att_value = h.getAttribute(att_name)` returns the value of a specific attribute in `coder.make.ToolchainInfo.Attributes`.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`att_name` — Name of attribute

string

Name of attribute, specified as a string of alphanumeric characters.

Data Types: `char`

Output Arguments

`att_value` — Value of attribute

true (default)

Attribute value. Any data type.

Examples

```
h.Attribute

ans =


# -------------------
# "Attribute" List
# -------------------
(empty)

h.addAttribute('TransformPathsWithSpaces',false)
h.getAttribute('TransformPathsWithSpaces')

ans  =

     0
```

See Also

`coder.make.ToolchainInfo.addAttribute` | `coder.make.ToolchainInfo.getAttribute` | `coder.make.ToolchainInfo.getAttributes` | `coder.make.ToolchainInfo.isAttribute` | `coder.make.ToolchainInfo.removeAttribute`

More About

- “About coder.make.ToolchainInfo”

getAttributes

Class: coder.make.ToolchainInfo
Package: coder.make

Get list of attribute names

Syntax

```
names = h.getAttributes
```

Description

`names = h.getAttributes` returns the list of attribute names in `coder.make.ToolchainInfo.Attributes`.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

Output Arguments

`names` — List of names

A list of the names, returned as a cell array.

Data Types: `cell`

Examples

```
h.addAttribute('FirstAttribute')
```

```
h.addAttribute('SecondAttribute')
h.addAttribute('ThirdAttribute')
names = h.getAttributes


names =

    'FirstAttribute'    'SecondAttribute'    'ThirdAttribute'
```

See Also

coder.make.ToolchainInfo.addAttribute | coder.make.ToolchainInfo.getAttribute | coder.make.ToolchainInfo.getAttributes | coder.make.ToolchainInfo.isAttribute | coder.make.ToolchainInfo.removeAttribute

More About

- “About coder.make.ToolchainInfo”

getBuildConfiguration

Class: coder.make.ToolchainInfo
Package: coder.make

Get handle for build configuration object

Syntax

```
bldcfg_handle = h.getBuildConfiguration(bldcfg_name)
```

Description

`bldcfg_handle = h.getBuildConfiguration(bldcfg_name)` returns a handle for the specified coder.make.BuildConfig object.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldcfg_name` — Build configuration name

string

Build configuration name, specified as a string.

Data Types: `char`

Output Arguments

`bldcfg_handle` — BuildConfiguration object handle

Handle of `coder.make.BuildConfiguration` object

Examples

```
bldcfg_handle = h.getBuildConfiguration('Debug')
```

```
bldcfg_handle =

##############################################
# Build Configuration : Debug
# Description         : Default debug settings for compiling/linking code
##############################################

ARFLAGS            = /nologo $(ARDEBUG)
CFLAGS             = $(cflags) $(CVARSFLAG) $(CFLAGS_ADDITIONAL) /c /Od $(CDEBUG)
CPPFLAGS           = $(cflags) $(CVARSFLAG) $(CPPFLAGS_ADDITIONAL) /c /Od $(CPPDEBUG)
DOWNLOAD_FLAGS     =
EXECUTE_FLAGS      =
LDFLAGS            = $(ldebug) $(conflags) $(LIBS_TOOLCHAIN) $(LDDEBUG)
MEX_CFLAGS         =
MEX_LDFLAGS        =
MAKE_FLAGS         = -f $(MAKEFILE)
SHAREDLIB_LDFLAGS  = $(ldebug) $(conflags) $(LIBS_TOOLCHAIN) -dll -def:$(DEF_FILE) $(LDDEBUG)
```

See Also

`coder.make.ToolchainInfo.getBuildConfiguration` | `coder.make.ToolchainInfo.removeBuildConfiguration` | `coder.make.ToolchainInfo.setBuildConfiguration` | `coder.make.ToolchainInfo.setBuildConfigurationOption`

More About

- "About coder.make.ToolchainInfo"

getBuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Get `BuildTool` object

Syntax

```
bldtl_handle = h.getBuildTool(bldtl_name)
```

Description

`bldtl_handle = h.getBuildTool(bldtl_name)` returns the `BuildTool` object that has the specified name.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

Output Arguments

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

```
bldtl_handle = h.getBuildTool('C Compiler')


bldtl_handle =

##############################################
# Build Tool: Intel C Compiler
##############################################

Language              : 'C'
OptionsRegistry       : {'C Compiler','CFLAGS'}
InputFileExtensions   : {'Source'}
OutputFileExtensions  : {'Object'}
DerivedFileExtensions : {'|>OBJ_EXT<|'}
SupportedOutputs      : {'*'}
CommandPattern        : '|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|'

# ---------
# Command
# ---------
CC = icl
CC_PATH  =

# ------------
# Directives
# ------------
Debug              = -Zi
Include            =
IncludeSearchPath  = -I
OutputFlag         = -Fo
PreprocessorDefine = -D

# -----------------
# File Extensions
# -----------------
Header = .h
Object = .obj
Source = .c
```

See Also

`coder.make.BuildTool` | `coder.make.ToolchainInfo.addBuildTool` | `coder.make.ToolchainInfo.getBuildTool` | `coder.make.ToolchainInfo.removeBuildTool` | `coder.make.ToolchainInfo.setBuildTool`

More About

- “About coder.make.ToolchainInfo”

getMacro

Class: coder.make.ToolchainInfo
Package: coder.make

Get value of macro

Syntax

```
value = h.getMacro(macroname)
```

Description

`value = h.getMacro(macroname)` returns the value of the specified macro.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`macroname` — Name of macro

Name of macro.

Output Arguments

`macrovalue` — Value of macro

string | cell

Value of the macro, specified as a string or cell array.

If the value contains MATLAB functions or other macros, ToolchainInfo interprets the value of functions and macros.

Data Types: `cell` | `char`

Examples

```
h.setMacro('CYGWIN','C:\cygwin\');
h.getMacro('CYGWIN')
```

```
ans  =

C:\cygwin\bin\
```

```
h.removeMacro('CYGWIN')
```

See Also

`coder.make.ToolchainInfo.addMacro` | `coder.make.ToolchainInfo.getMacro` | `coder.make.ToolchainInfo.removeMacro` | `coder.make.ToolchainInfo.setMacro` | `coder.make.ToolchainInfo.addIntrinsicMacros` | `coder.make.ToolchainInfo.removeIntrinsicMacros`

More About

- "About coder.make.ToolchainInfo"

getPostbuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Get postbuild `BuildTool` object

Syntax

```
bldtl_handle = h.getPostbuildTool(bldtl_name)
```

Description

`bldtl_handle = h.getPostbuildTool(bldtl_name)` gets the named `BuildTool` object from `PostbuildTool` and assigns it to a handle.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

Output Arguments

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

```
h.getPostbuildTool('Download')


ans =

##############################################
# Build Tool: Download
##############################################

Language               : ''
OptionsRegistry        : {'Download','DOWNLOAD_FLAGS'}
InputFileExtensions    : {}
OutputFileExtensions   : {}
DerivedFileExtensions  : {}
SupportedOutputs       : {coder.make.enum.BuildOutput.EXECUTABLE}
CommandPattern         : '|>TOOL<| |>TOOL_OPTIONS<|'

# ---------
# Command
# ---------
DOWNLOAD  =
DOWNLOAD_PATH  =

# ------------
# Directives
# ------------
(none)

# -----------------
# File Extensions
# -----------------
(none)
```

See Also

coder.make.ToolchainInfo.addPostbuildTool | coder.make.ToolchainInfo.getPostbuildTool | coder.make.ToolchainInfo.removePostbuildTool | coder.make.ToolchainInfo.setPostbuildTool | coder.make.ToolchainInfo.addPostDownloadTool | coder.make.ToolchainInfo.addPostExecuteTool

More About

- “About coder.make.ToolchainInfo”

getPrebuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Get prebuild `BuildTool` object

Syntax

```
bldtl_handle = tc.getPrebuildTool(bldtl_name)
```

Description

`bldtl_handle = tc.getPrebuildTool(bldtl_name)` gets the named `BuildTool` object from `PrebuildTool` and assigns it to a handle.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

Output Arguments

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

```
h.getPrebuildTool(‘Copy Tool’)


ans =

##############################################
# Build Tool: Copy Tool
##############################################

Language              : ''
OptionsRegistry       : {'Copy','COPY_FLAGS'}
InputFileExtensions   : {}
OutputFileExtensions  : {}
DerivedFileExtensions : {}
SupportedOutputs      : {coder.make.enum.BuildOutput.EXECUTABLE}
CommandPattern        : '|>TOOL<| |>TOOL_OPTIONS<|'

# ---------
# Command
# ---------
COPY  =
COPY_PATH  =

# ------------
# Directives
# ------------
(none)

# -----------------
# File Extensions
# -----------------
(none)
```

See Also

`coder.make.ToolchainInfo.addPrebuildTool` | `coder.make.ToolchainInfo.getPrebuildTool` | `coder.make.ToolchainInfo.removePrebuildTool` | `coder.make.ToolchainInfo.setPrebuildTool`

More About

- "About coder.make.ToolchainInfo"

coder.make.ToolchainInfo.getSupportedLanguages

Class: coder.make.ToolchainInfo
Package: coder.make

Get list of supported languages

Syntax

```
lng_list = h.getSupportedLanguages
```

Description

`lng_list = h.getSupportedLanguages` returns the list of supported code generation languages for the current toolchain.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

Output Arguments

`lng_list` — List of supported languages
cell

List of supported languages, returned as a cell.

Attributes

`Static`	`true`

To learn about attributes of methods, see Method Attributes in the MATLAB Object-Oriented Programming documentation.

Examples

```
ans = h.getSupportedLanguages


ans = 

    'Asm/C'    'Asm/C++'    'Asm/C/C++'    'C'    'C++'    'C/C++'
```

See Also

`coder.make.ToolchainInfo`

More About

- "About coder.make.ToolchainInfo"

isAttribute

Class: coder.make.ToolchainInfo
Package: coder.make

Determine if attribute exists

Syntax

```
truefalse = h.isAttribute(att_name)
```

Description

`truefalse = h.isAttribute(att_name)` returns a logical value that indicates whether the specified attribute is a member of `coder.make.ToolchainInfo.Attributes`.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`att_name` — Name of attribute

string

Name of attribute, specified as a string of alphanumeric characters.

Data Types: `char`

Output Arguments

`truefalse` — Logical value

boolean

Logical value: 0 = false, 1 = true, specified as a logical value.

Data Types: `logical`

Examples

```
h.addAttribute('FirstAttribute')
truefalse = h.isAttribute('FirstAttribute')
```

```
truefalse  =

     1
```

See Also

`coder.make.ToolchainInfo.addAttribute` | `coder.make.ToolchainInfo.getAttribute` | `coder.make.ToolchainInfo.getAttributes` | `coder.make.ToolchainInfo.isAttribute` | `coder.make.ToolchainInfo.removeAttribute`

More About

- "About coder.make.ToolchainInfo"

removeAttribute

Class: coder.make.ToolchainInfo
Package: coder.make

Remove attribute

Syntax

```
h.removeAttribute(att_name)
```

Description

`h.removeAttribute(att_name)` removes the named attribute from `coder.make.ToolchainInfo.Attributes`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`att_name` — Name of attribute

string

Name of attribute, specified as a string of alphanumeric characters.

Data Types: `char`

Examples

```
h.addAttribute('FirstAttribute')
h.isAttribute('FirstAttribute')
```

```
ans =

     1

h.removeAttribute('FirstAttribute')
h.isAttribute('FirstAttribute')


ans =

     0
```

See Also

`coder.make.ToolchainInfo.addAttribute` | `coder.make.ToolchainInfo.getAttribute` | `coder.make.ToolchainInfo.getAttributes` | `coder.make.ToolchainInfo.isAttribute` | `coder.make.ToolchainInfo.removeAttribute`

More About

- "About coder.make.ToolchainInfo"

removeBuildConfiguration

Class: coder.make.ToolchainInfo
Package: coder.make

Remove build configuration

Syntax

```
h.removeBuildConfiguration(bldcfg_name)
```

Description

`h.removeBuildConfiguration(bldcfg_name)` removes the specified build configuration object from `coder.make.ToolchainInfo.BuildConfiguration`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldcfg_name` — Build configuration name

string

Build configuration name, specified as a string.

Data Types: `char`

Examples

```
h.BuildConfigurations

ans =
# ----------------------------
# "BuildConfigurations" List
# ----------------------------
Debug        =  <coder.make.BuildConfiguration>
ExampleName      =  <coder.make.BuildConfiguration>
Faster Builds = <coder.make.BuildConfiguration>
Faster Runs   = <coder.make.BuildConfiguration>

h.removeBuildConfiguration('ExampleName')
h.BuildConfigurations


ans =


# ----------------------------
# "BuildConfigurations" List
# ----------------------------
Debug        =  <coder.make.BuildConfiguration>
Faster Builds = <coder.make.BuildConfiguration>
Faster Runs   = <coder.make.BuildConfiguration>
```

See Also

`coder.make.ToolchainInfo.getBuildConfiguration` | `coder.make.ToolchainInfo.removeBuildConfiguration` | `coder.make.ToolchainInfo.setBuildConfiguration` | `coder.make.ToolchainInfo.setBuildConfigurationOption`

More About

- "About coder.make.ToolchainInfo"

removeBuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Remove `BuildTool` object from `BuildTools`

Syntax

```
h.removeBuildTool(bldtl_name)
```

Description

`h.removeBuildTool(bldtl_name)` removes the named build tool from `BuildTools`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

Examples

```
h.addBuildTool('ExampleBuildTool');
h.BuildTools


ans =
# -------------------
# "BuildTools" List
# -------------------
C Compiler       = <coder.make.BuildTool>
C++ Compiler     = <coder.make.BuildTool>
Archiver         = <coder.make.BuildTool>
Linker           = <coder.make.BuildTool>
MEX Tool         = <coder.make.BuildTool>
ExampleBuildTool = <coder.make.BuildTool>


h.removeBuildTool('ExampleBuildTool')
h.BuildTools


ans =


# -------------------
# "BuildTools" List
# -------------------
C Compiler       = <coder.make.BuildTool>
C++ Compiler     = <coder.make.BuildTool>
Archiver         = <coder.make.BuildTool>
Linker           = <coder.make.BuildTool>
MEX Tool         = <coder.make.BuildTool>
```

See Also

`coder.make.BuildTool` | `coder.make.ToolchainInfo.addBuildTool` | `coder.make.ToolchainInfo.getBuildTool` | `coder.make.ToolchainInfo.removeBuildTool` | `coder.make.ToolchainInfo.setBuildTool`

More About

- “About coder.make.ToolchainInfo”

removeIntrinsicMacros

Class: coder.make.ToolchainInfo
Package: coder.make

Remove intrinsic macro

Syntax

```
h.removeIntrinsicMacros(intrnsc_macronames)
```

Description

`h.removeIntrinsicMacros(intrnsc_macronames)` removes the named intrinsic macro from `Macros`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`intrnsc_macronames` — Intrinsic macro name or names

Intrinsic macro name or names, specified as a string or cell array of strings.

Examples

```
h.addIntrinsicMacros('GCCROOT')
h.getMacro('GCCROOT')


ans  =

     []
```

```
h.removeIntrinsicMacros('GCCROOT')
h.getMacro('GCCROOT')
```

See Also

`coder.make.ToolchainInfo.addMacro` | `coder.make.ToolchainInfo.getMacro` | `coder.make.ToolchainInfo.removeMacro` | `coder.make.ToolchainInfo.setMacro` | `coder.make.ToolchainInfo.addIntrinsicMacros` | `coder.make.ToolchainInfo.removeIntrinsicMacros`

More About

- “About coder.make.ToolchainInfo”

removeMacro

Class: coder.make.ToolchainInfo
Package: coder.make

Remove macro from `Macros`

Syntax

```
h.removeMacro(macroname)
```

Description

`h.removeMacro(macroname)` removes a macro from `coder.make.ToolchainInfo.Macros`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`macroname` — Name of macro

Name of macro.

Examples

```
h.setMacro('CYGWIN','C:\cygwin\');
h.getMacro('CYGWIN')
```

```
ans  =

C:\cygwin\bin\
h.removeMacro('CYGWIN')
```

See Also

`coder.make.ToolchainInfo.addMacro` | `coder.make.ToolchainInfo.getMacro` | `coder.make.ToolchainInfo.removeMacro` | `coder.make.ToolchainInfo.setMacro` | `coder.make.ToolchainInfo.addIntrinsicMacros` | `coder.make.ToolchainInfo.removeIntrinsicMacros`

More About

- “About coder.make.ToolchainInfo”

removePostbuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Remove postbuild build tool

Syntax

```
h.removePostbuildTool(bldtl_name)
```

Description

`h.removePostbuildTool(bldtl_name)` removes the named build tool from `PostbuildTools`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name
string

Build tool name, specified as a string.

Data Types: `char`

Examples

```
h.addPostbuildTool('copier');
h.PostbuildTools
```

```
ans =


# ----------------------
# "PostbuildTools" List
# ----------------------
copier   = <coder.make.BuildTool>
Download = <coder.make.BuildTool>
Execute  = <coder.make.BuildTool>


h.removePostbuildTool('copier')
```

See Also

`coder.make.ToolchainInfo.addPostbuildTool` | `coder.make.ToolchainInfo.getPostbuildTool` | `coder.make.ToolchainInfo.removePostbuildTool` | `coder.make.ToolchainInfo.setPostbuildTool` | `coder.make.ToolchainInfo.addPostDownloadTool` | `coder.make.ToolchainInfo.addPostExecuteTool`

More About

- "About coder.make.ToolchainInfo"

removePrebuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Remove prebuild build tool

Syntax

```
h.removePrebuildTool(bldtl_name)
```

Description

`h.removePrebuildTool(bldtl_name)` removes the named build tool from `PrebuildTools`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

Examples

If you have an example `coder.make.ToolchainInfo.PrebuildTools` object that contains a `BuildTool` object such as `copyFiles`:

```
h.PrebuildTools
```

```
ans =


# ----------------------
# "PrebuildTools" List
# ----------------------
copyFiles = <coder.make.BuildTool>

h.removePrebuildTool('copyFiles')
```

See Also

`coder.make.ToolchainInfo.addPrebuildTool` | `coder.make.ToolchainInfo.getPrebuildTool` | `coder.make.ToolchainInfo.removePrebuildTool` | `coder.make.ToolchainInfo.setPrebuildTool`

More About

- “About coder.make.ToolchainInfo”

setBuildConfiguration

Class: coder.make.ToolchainInfo
Package: coder.make

Set value of specified build configuration

Syntax

```
h.setBuildConfiguration(bldcfg_name, bldcfg_handle)
```

Description

`h.setBuildConfiguration(bldcfg_name, bldcfg_handle)` assigns a build configuration object to a build configuration in `coder.make.ToolchainInfo.BuildConfigurations`.

Tips

Before you can use this method, add a build configuration to `BuildConfigurations` using `coder.make.ToolchainInfo.addBuildConfiguration` with a `bldcfg_name` argument.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldcfg_name` — Build configuration name

string

Build configuration name, specified as a string.

Data Types: `char`

`bldcfg_handle` — BuildConfiguration object handle

Handle of `coder.make.BuildConfiguration` object

Examples

```
h.getBuildConfigurations


ans =

    'Faster Builds'
    'Faster Runs'
    'Debug'
```

```
bldcfg_handle = h.getBuildConfiguration('Debug')
```

```
bldcfg_handle =

##############################################
# Build Configuration : Debug
# Description         : Default debug settings for compiling/linking code
##############################################

ARFLAGS            = /nologo $(ARDEBUG)
CFLAGS             = $(cflags) $(CVARSFLAG) $(CFLAGS_ADDITIONAL) /c /Od $(CDEBUG)
CPPFLAGS           = $(cflags) $(CVARSFLAG) $(CPPFLAGS_ADDITIONAL) /c /Od $(CPPDEBUG)
DOWNLOAD_FLAGS     =
EXECUTE_FLAGS      =
LDFLAGS            = $(ldebug) $(conflags) $(LIBS_TOOLCHAIN) $(LDDEBUG)
MEX_CFLAGS         =
MEX_LDFLAGS        =
MAKE_FLAGS         = -f $(MAKEFILE)
SHAREDLIB_LDFLAGS  = $(ldebug) $(conflags) $(LIBS_TOOLCHAIN) -dll -def:$(DEF_FILE) $(LDDEBUG)
```

```
h.addBuildConfiguration('Debug2','Variant debugging configuration')
h.setBuildConfiguration('Debug2',bldcfg_handle)
h.getBuildConfigurations


ans =

    'Faster Builds'
    'Faster Runs'
    'Debug'
    'Debug2'
```

See Also

`coder.make.ToolchainInfo.getBuildConfiguration` | `coder.make.ToolchainInfo.removeBuildConfiguration`

| `coder.make.ToolchainInfo.setBuildConfiguration` | `coder.make.ToolchainInfo.setBuildConfigurationOption`

More About

- “About coder.make.ToolchainInfo”

setBuildConfigurationOption

Class: coder.make.ToolchainInfo
Package: coder.make

Sets value of build tool options for build configuration

Syntax

```
h.setBuildConfigurationOption(buildconfignames, options)
```

Description

`h.setBuildConfigurationOption(buildconfignames, options)` sets option values for the named `coder.make.BuildConfiguration` objects in `coder.make.ToolchainInfo.BuildConfigurations`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`buildconfignames` — Build configuration names

Build configuration name or `'all'`, specified as a string.

`buildobjectname` — BuildTool object name

`BuildTool` object name, specified as a string.

`options` — Build configuration options

Build configuration options, specified as a string.

Examples

To update a specific `BuildConfiguration` object or objects:

```
h = coder.make.ToolchainInfo
h.setBuildConfigurationOption('Faster Runs','C Compiler','-c -g')
```

To update all `BuildConfiguration` objects:

```
h = coder.make.ToolchainInfo
tc.setBuildConfigurationOption(‘all’,‘C Compiler’,‘-c -g’)
```

See Also

`coder.make.ToolchainInfo.getBuildConfiguration` | `coder.make.ToolchainInfo.removeBuildConfiguration` | `coder.make.ToolchainInfo.setBuildConfiguration` | `coder.make.ToolchainInfo.setBuildConfigurationOption`

More About

- “About coder.make.ToolchainInfo”

setBuilderApplication

Class: coder.make.ToolchainInfo
Package: coder.make

Update builder application to work on specific platform

Syntax

`h.setBuilderApplication(platform)`

Description

`h.setBuilderApplication(platform)` updates options in the `coder.make.BuildTool` object in `coder.make.ToolchainInfo.BuilderApplication` to work on a specific platform.

Tips

- You must use this method you if you plan to use the custom toolchain on computer running Windows and the value of `coder.make.ToolchainInfo.BuildArtifact` is `gmake makefile`.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`platform` — Host computer platform
string

Host computer platform, specified as a scalar. The values can be:

- `WIN32`

- `WIN64`
- `MACI64`
- `GLNXA64`

Data Types: `char`

Examples

The `intel_tc.m` file from "Adding a Custom Toolchain", uses the following lines to update the `BuilderApplication` property:

```
% ------------------------------
% Builder
% ------------------------------

tc.setBuilderApplication(tc.Platform);
```

setBuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Assign `BuildTool` object to named build tool in `BuildTools`

Syntax

```
h.setBuildTool(bldtl_name, bldtl_handle)
```

Description

`h.setBuildTool(bldtl_name, bldtl_handle)` assigns a `BuildTool` object to the named build tool in `coder.make.ToolchainInfo.BuildTools`.

Tips

Refer to the "Example" on page 3-130 for `coder.make.BuildTool` for an example of how to create a `BuildTool` object.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

```
h = coder.make.ToolchainInfo;
bt = coder.make.BuildTool('examplename')
h.setBuildTool('Archiver',bt)
```

See Also

`coder.make.BuildTool` | `coder.make.ToolchainInfo.addBuildTool` | `coder.make.ToolchainInfo.getBuildTool` | `coder.make.ToolchainInfo.removeBuildTool` | `coder.make.ToolchainInfo.setBuildTool`

More About

- “About coder.make.ToolchainInfo”

setMacro

Class: coder.make.ToolchainInfo
Package: coder.make

Set value of macro

Syntax

```
h.setMacro(macroname, value)
```

Description

`h.setMacro(macroname, value)` sets the value of a macro.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`macroname` — Name of macro

Name of macro.

`macrovalue` — Value of macro

string | cell

Value of the macro, specified as a string or cell array.

If the value contains MATLAB functions or other macros, ToolchainInfo interprets the value of functions and macros.

Data Types: `cell` | `char`

Examples

```
h.setMacro('CYGWIN','C:\cygwin\');
h.getMacro('CYGWIN')


ans  =

C:\cygwin\bin\


h.removeMacro('CYGWIN')
```

See Also

`coder.make.ToolchainInfo.addMacro` | `coder.make.ToolchainInfo.getMacro` | `coder.make.ToolchainInfo.removeMacro` | `coder.make.ToolchainInfo.setMacro` | `coder.make.ToolchainInfo.addIntrinsicMacros` | `coder.make.ToolchainInfo.removeIntrinsicMacros`

More About

- “About coder.make.ToolchainInfo”

setPostbuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Assign `BuildTool` object to `PostbuildTool` tool in `PostbuildTools`

Syntax

```
h.setPostbuildTool(bldtl_name, bldtl_handle)
```

Description

`h.setPostbuildTool(bldtl_name, bldtl_handle)` assigns a `BuildTool` object to the named build tool in coder.make.ToolchainInfo.PostbuildTools.

Input Arguments

`h` — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

`bldtl_handle` — BuildTool object handle

Handle of `coder.make.BuildTool` object.

Examples

```
h = coder.make.ToolchainInfo;
```

```
bt = coder.make.BuildTool('examplename')
h.addPostbuildTool('toolname')
h.setPostbuildTool('toolname',bt)
```

See Also

`coder.make.ToolchainInfo.addPostbuildTool` | `coder.make.ToolchainInfo.getPostbuildTool` | `coder.make.ToolchainInfo.removePostbuildTool` | `coder.make.ToolchainInfo.setPostbuildTool` | `coder.make.ToolchainInfo.addPostDownloadTool` | `coder.make.ToolchainInfo.addPostExecuteTool`

More About

- “About coder.make.ToolchainInfo”

setPrebuildTool

Class: coder.make.ToolchainInfo
Package: coder.make

Assign `BuildTool` object to named `PrebuildTool` in `PrebuildTools`

Syntax

```
h.setPrebuildTool(bldtl_name, bldtl_handle)
```

Description

`h.setPrebuildTool(bldtl_name, bldtl_handle)` assigns a `BuildTool` object to the named build tool in coder.make.ToolchainInfo.PrebuildTools.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`bldtl_name` — Build tool name

string

Build tool name, specified as a string.

Data Types: `char`

Examples

```
h = coder.make.ToolchainInfo;
bt = coder.make.BuildTool('examplename');
h.addPrebuildTool('toolname');
h.setPrebuildTool('toolname',bt)
```

See Also

`coder.make.ToolchainInfo.addPrebuildTool` |
`coder.make.ToolchainInfo.getPrebuildTool` |
`coder.make.ToolchainInfo.removePrebuildTool` |
`coder.make.ToolchainInfo.setPrebuildTool`

More About

- “About coder.make.ToolchainInfo”

setup

Class: coder.make.ToolchainInfo
Package: coder.make

Invoke toolchain setup commands specified by MATLABSetup and ShellSetup

Syntax

```
h.setup
```

Description

`h.setup` runs setup commands before starting the software build process. First, it runs the commands specified by `coder.make.ToolchainInfo.MATLABSetup`, and then it runs the commands specified by `coder.make.ToolchainInfo.ShellSetup`.

The commands in `MATLABSetup` run in your MATLAB software.

The commands in `ShellSetup` run as system calls to the standard input of the operating system on your host computer. These commands are similar to what you enter when you use the command line.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

Output Arguments

`success` — Response indicating whether setup completed
double

Response indicating whether setup completed (`0` = false, `1` = true), returned as a double.

`report` — Detailed information generated by setup commands
string

Detailed information generated by the setup commands, returned as a string.

Examples

```
[success,report] = h.setup


success  =

     1


report  =

     ''
```

See Also

`coder.make.ToolchainInfo.cleanup` | `coder.make.ToolchainInfo.validate`

More About

- "About coder.make.ToolchainInfo"

validate

Class: coder.make.ToolchainInfo
Package: coder.make

Validate toolchain

Syntax

```
h.validate
h.validate('setup','cleanup')
[success, report] = h.validate (___)
```

Description

`h.validate` validates the toolchain object and generates errors if any properties are incorrectly defined.

`h.validate('setup','cleanup')` evaluates the setup callbacks (`ShellSetup` and `MATLABSetup`) of the toolchain object before validation and evaluates the cleanup callbacks (`ShellCleanup` and `MATLABCleanup`) of the toolchain object after validation. The Configuration Parameters dialog box executes this version of validate when validating the toolchain.

`[success, report] = h.validate (___)` validates the toolchain object, generates errors if any properties are incorrectly defined, and returns optional output arguments.

Input Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

`'setup'` — Setup argument for validate operation.

Evaluates `coder.make.ToolchainInfo.setup` for the toolchain.

`'cleanup'` — Cleanup argument for validate operation.

Evaluates `coder.make.ToolchainInfo.cleanup` for the toolchain.

Output Arguments

`success` — Response indicating whether validate passed
double

Response indicating whether validate passed, returned as a numeric value. If any of the property values the method checks are invalid, the method returns `0`. Otherwise, it returns `1`.

`report` — Information about which properties are invalid
string

Information about which properties are invalid. Only available when the method returns `0`.

Examples

Validate a toolchain before it has been installed

If you validate a default toolchain before all the build tools are specified, `validate` notifies you of the build tools that are not specified.

```
h = coder.make.ToolchainInfo;
[success,report] = h.validate
```

```
success  =

     1


report  =

Toolchain Validation Result: Passed

Validation report:
```

```
### Validation of build tool "C Compiler"
 Skipped. No "C Compiler" build tool is specified.

### Validation of build tool "C++ Compiler"
 Skipped. No "C++ Compiler" build tool is specified.

### Validation of build tool "Archiver"
 Skipped. No "Archiver" build tool is specified.

### Validation of build tool "Linker"
 Skipped. No "Linker" build tool is specified.

### Validation of build tool "MEX Tool"
Checking for existence of path: $(MATLAB_BIN)
 Passed.
Checking for tool command: mex
 Passed.

### Validation of build tool "Download"
 Skipped. No "Download" build tool is specified.

### Validation of build tool "Execute"
 Skipped. "Execute" build tool "$(PRODUCT)" cannot be validated.

### Validation of build tool "GMAKE Utility"
Checking for existence of path: %MATLAB%\bin\win64
 Passed.
Checking for tool command: gmake
 Passed.

### Checking for undeclared macros ...
 Passed.
```

Validate a toolchain before it has been installed

```
[success,report] = tc.validate
```

```
Error using ToolchainInfo.validate (line 270)
Validation error(s):
### Validating other build tools ...

Unable to locate build tool "Intel C Compiler": icl
 Unable to locate build tool "Intel C++ Compiler": icl
 Unable to locate build tool "Intel C/C++ Archiver": xilib
 Unable to locate build tool "Intel C/C++ Linker": xilink
 Unable to locate build tool "NMAKE Utility": nmake
```

See Also

`coder.make.ToolchainInfo.cleanup` | `coder.make.ToolchainInfo.setup`

More About

- "About coder.make.ToolchainInfo"

getHardwareImplementation

Class: coder.BuildConfig
Package: coder

Get handle of copy of hardware implementation object

Syntax

```
hw = bldcfg.getHardwareImplementation()
```

Description

`hw = bldcfg.getHardwareImplementation()` returns the handle of a copy of the hardware implementation object.

Input Arguments

`bldcfg`

`coder.BuildConfig` object.

Output Arguments

`hw`

Handle of copy of hardware implementation object.

See Also

coder.HardwareImplementation

getStdLibInfo

Class: coder.BuildConfig
Package: coder

Get standard library information

Syntax

```
[linkLibPath,linkLibExt,execLibExt,libPrefix]=
bldcfg.getStdLibInfo()
```

Description

`[linkLibPath,linkLibExt,execLibExt,libPrefix]=`
`bldcfg.getStdLibInfo()` returns strings representing the:

- Standard MATLAB architecture-specific library path
- Platform-specific library file extension for use at link time
- Platform-specific library file extension for use at run time
- Standard architecture-specific library name prefix

Input Arguments

`bldcfg`

`coder.BuildConfig` object.

Output Arguments

`linkLibPath`

Standard MATLAB architecture-specific library path specified as a string. The string can be empty.

`linkLibExt`

Platform-specific library file extension for use at link time, specified as a string. The value is one of `'.lib'`,`'.dylib'`,`'.so'`, `''`.

`execLibExt`

Platform-specific library file extension for use at run time, specified as a string. the value is one of `'.dll'`,`'.dylib'`,`'.so'`, `''`.

`linkPrefix`

Standard architecture-specific library name prefix, specified as a string. The string can be empty.

getTargetLang

Class: coder.BuildConfig
Package: coder

Get target code generation language

Syntax

```
lang = bldcfg.getTargetLang()
```

Description

`lang = bldcfg.getTargetLang()` returns a string containing the target code generation language.

Input Arguments

`bldcfg`

`coder.BuildConfig` object.

Output Arguments

`lang`

A string containing the target code generation language. The value is ‘C’ or ‘C++’.

getToolchainInfo

Class: coder.BuildConfig
Package: coder

Returns handle of copy of toolchain information object

Syntax

```
tc = bldcfg.getToolchainInfo()
```

Description

`tc = bldcfg.getToolchainInfo()` returns a handle of a copy of the toolchain information object.

Input Arguments

`bldcfg`

`coder.BuildConfig` object.

Output Arguments

`tc`

Handle of copy of toolchain information object.

See Also

coder.make.ToolchainInfo

isCodeGenTarget

Class: coder.BuildConfig
Package: coder

Determine if build configuration represents specified target

Syntax

```
tf = bldcfg.isCodeGenTarget(target)
```

Description

`tf = bldcfg.isCodeGenTarget(target)` returns true (1) if the code generation target of the current build configuration represents the code generation target specified by `target`. Otherwise, it returns false (0).

Input Arguments

`bldcfg`

`coder.BuildConfig` object.

`target`

Code generation target specified as a string or cell array of strings.

Specify	For code generation target
`'rtw'`	C/C++ dynamic Library, C/C++ static library, or C/C ++ executable
`'sfun'`	S-function (Simulation)
`'mex'`	MEX-function

Specify `target` as a cell array of strings to test if the code generation target of the build configuration represents one of the targets specified in the cell array.

For example:

```
...
mytarget = {'sfun','mex'};
tf = bldcfg.isCodeGenTarget(mytarget);
...
```

tests whether the build context represents an S-function target or a MEX-function target.

Output Arguments

`tf`

The value is true (1) if the code generation target of the build configuration represents the code generation target specified by `target`. Otherwise, the value is false (0).

See Also

`coder.target`

isMatlabHostTarget

Class: coder.BuildConfig
Package: coder

Determine if hardware implementation object target is MATLAB host computer

Syntax

```
tf = bldcfg.isMatlabHostTarget()
```

Description

`tf = bldcfg.isMatlabHostTarget()` returns true (1) if the current hardware implementation object targets the MATLAB host computer. Otherwise, it returns false (0).

Input Arguments

`bldcfg`

`coder.BuildConfig` object.

Output Arguments

`tf`

Value is true (1) if the current hardware implementation object targets the MATLAB host computer. Otherwise, the value is false (0).

See Also

coder.HardwareImplementation

isHeterogeneous

Class: coder.CellType
Package: coder

Determine whether cell array type represents a heterogeneous cell array

Syntax

```
tf = isHeterogeneous(t)
```

Description

`tf = isHeterogeneous(t)` returns `true` if the `coder.CellType` object `t` is heterogeneous. Otherwise, it returns `false`.

Examples

Determine Whether Cell Array Type Is Heterogeneous

Create a `coder.CellType` object for a cell array whose elements have different classes.

```
t = coder.typeof({'a', 1})
```

```
t =

coder.CellType
   1x2 heterogeneous cell
      f0: 1x1 char
      f1: 1x1 double
```

Determine whether the `coder.CellType` object represents a heterogeneous cell array.

```
isHeterogeneous(t)
```

```
ans =
     1
```

Test for Heterogeneous Cell Array Type Before Executing Code

Write a function `assign_name`. If the input type `t` is heterogeneous, the function returns a copy of `t`. The copy specifies the name for the structure type that represents the cell array type in the generated code.

```
function ts = assign_name(t, str_name)
assert(isHeterogeneous(t));
ts = coder.cstructname(t, str_name);
disp ts
end
```

Create a homogeneous type `tc`.

```
tc = coder.typeof({1 2 3});
```

Pass `tc` to `make_varsize`.

```
tc1 = assign_name(tc, 'myname')
```

The assertions fails because `tc` is not heterogeneous.

Create a heterogeneous type `tc`.

```
tc = coder.typeof({'a' 1});
```

Pass `tc` to `make_varsize`.

```
tc1 = assign_name(tc, 'myname')
```

```
tc1 =

coder.CellType
   1x2 heterogeneous cell myname
      f0: 1x1 char
      f1: 1x1 double
```

- “Specify Cell Array Inputs at the Command Line”

Tips

- `coder.typeof` determines whether the cell array type is homogeneous or heterogeneous. If the cell array elements have the same class and size, `coder.typeof` returns a homogeneous cell array type. If the elements have different classes, `coder.typeof` returns a heterogeneous cell array type. For some cell arrays, the classification as homogeneous or heterogeneous is ambiguous. For example, the type for {1 [2 3]} can be a 1x2 heterogeneous type. The first element is double and the second element is 1x2 double. The type can also be a 1x3 homogeneous type in which the elements have class double and size 1x:2. For these ambiguous cases, `coder.typeof` uses heuristics to classify the type as homogeneous or heterogeneous. If you want a different classification, use the `makeHomogeneous` or `makeHeterogeneous` methods. The `makeHomogeneous` method makes a homogeneous copy of a type. The `makeHeterogeneous` method makes a heterogeneous copy of a type.

The `makeHomogeneous` and `makeHeterogeneous` methods permanently assign the classification as homogeneous and heterogeneous, respectively. You cannot later use one of these methods to create a copy that has a different classification.

See Also

`coder.newtype` | `coder.typeof`

More About

- "Homogeneous vs. Heterogeneous Cell Arrays"

Introduced in R2015b

isHomogeneous

Class: coder.CellType
Package: coder

Determine whether cell array type represents a homogeneous cell array

Syntax

```
tf = isHomogeneous(t)
```

Description

`tf = isHomogeneous(t)` returns `true` if the `coder.CellType` object `t` represents a homogeneous cell array. Otherwise, it returns `false`.

Examples

Determine Whether Cell Array Type Is Homogeneous.

Create a `coder.CellType` object for a cell array whose elements have the same class and size.

```
t = coder.typeof({1 2 3})
```

```
t =

coder.CellType
   1x3 homogeneous cell
      base: 1x1 double
```

Determine whether the `coder.CellType` object represents a homogeneous cell array.

```
isHomogeneous(t)
```

```
ans =
     1
```

Test for a Homogeneous Cell Array Type Before Executing Code

Write a function `make_varsize`. If the input type `t` is homogeneous, the function returns a variable-size copy of `t`.

```
function c = make_varsize(t, n)
assert(isHomogeneous(t));
c = coder.typeof(t, [n n], [1 1]);
end
```

Create a heterogeneous type `tc`.

```
tc = coder.typeof({'a', 1});
```

Pass `tc` to `make_varsize`.

```
tc1 = make_varsize(tc, 5)
```

The assertion fails because `tc` is heterogeneous.

Create a homogeneous type `tc`.

```
tc = coder.typeof({1 2 3});
```

Pass `tc` to `make_varsize`.

```
tc1 = make_varsize(tc, 5)
```

```
tc1 =

coder.CellType
   :5x:5 homogeneous cell
      base: 1x1 double
```

- “Specify Cell Array Inputs at the Command Line”

Tips

- `coder.typeof` determines whether the cell array type is homogeneous or heterogeneous. If the cell array elements have the same class and size, `coder.typeof` returns a homogeneous cell array type. If the elements have different classes, `coder.typeof` returns a heterogeneous cell array type. For some cell arrays, the classification as homogeneous or heterogeneous is ambiguous. For example, the type for {1 [2 3]} can be a 1x2 heterogeneous type. The first element is double and the second element is 1x2 double. The type can also be a 1x3 homogeneous type in which the elements have class double and size 1x:2. For these ambiguous cases, `coder.typeof` uses heuristics to classify the type as homogeneous or heterogeneous. If you want a different classification, use the `makeHomogeneous` or `makeHeterogeneous` methods. The `makeHomogeneous` method makes a homogeneous copy of a type. The `makeHeterogeneous` method makes a heterogeneous copy of a type.

The `makeHomogeneous` and `makeHeterogeneous` methods permanently assign the classification as homogeneous and heterogeneous, respectively. You cannot later use one of these methods to create a copy that has a different classification.

See Also

`coder.newtype` | `coder.typeof`

More About

- "Homogeneous vs. Heterogeneous Cell Arrays"

Introduced in R2015b

makeHeterogeneous

Class: coder.CellType
Package: coder

Make a heterogeneous copy of a cell array type

Syntax

```
newt = makeHeterogeneous(t)
t = makeHeterogeneous(t)
```

Description

`newt = makeHeterogeneous(t)` creates a `coder.CellType` object for a heterogeneous cell array from the `coder.CellType` object `t`. `t` cannot represent a variable-size cell array.

The classification as heterogeneous is permanent. You cannot later create a homogeneous `coder.CellType` object from `newt`.

`t = makeHeterogeneous(t)` creates a heterogeneous `coder.CellType` object from `t` and replaces `t` with the new object.

Examples

Replace a Homogeneous Cell Array Type with a Heterogeneous Cell Array Type

Create a cell array type `t` whose elements have the same class and size.

```
t = coder.typeof({1 2 3})
```

```
t =

coder.CellType
   1x3 homogeneous cell
      base: 1x1 double
```

The cell array type is homogeneous.

Replace `t` with a cell array type for a heterogeneous cell array.

```
t = makeHeterogeneous(t)
```

```
coder.CellType
   1x3 heterogeneous cell
      f0: 1x1 double
      f1: 1x1 double
      f2: 1x1 double
```

The cell array type is heterogeneous. The elements have the size and class of the original homogeneous cell array type.

- "Specify Cell Array Inputs at the Command Line"

Tips

- `coder.typeof` determines whether the cell array type is homogeneous or heterogeneous. If the cell array elements have the same class and size, `coder.typeof` returns a homogeneous cell array type. If the elements have different classes, `coder.typeof` returns a heterogeneous cell array type. For some cell arrays, the classification as homogeneous or heterogeneous is ambiguous. For example, the type for {1 [2 3]} can be a 1x2 heterogeneous type. The first element is double and the second element is 1x2 double. The type can also be a 1x3 homogeneous type in which the elements have class double and size 1x:2. For these ambiguous cases, `coder.typeof` uses heuristics to classify the type as homogeneous or heterogeneous. If you want a different classification, use the `makeHomogeneous` or `makeHeterogeneous` methods.

See Also

`coder.newtype` | `coder.typeof`

More About

- "Homogeneous vs. Heterogeneous Cell Arrays"

Introduced in R2015b

makeHomogeneous

Class: coder.CellType
Package: coder

Create a homogeneous copy of a cell array type

Syntax

```
newt = makeHomogeneous(t)
t = makeHomogeneous(t)
```

Description

`newt = makeHomogeneous(t)` creates a `coder.CellType` object for a homogeneous cell array `newt` from the `coder.CellType` object `t`.

To create `newt`, the `makeHomogeneous` method must determine a size and class that represent all elements of `t`:

- If the elements of `t` have the same class, but different sizes, the elements of `newt` are variable size with upper bounds that accommodate the elements of `t`.
- If the elements of `t` have different classes, for example, `char` and `double`, the `makeHomogeneous` method cannot create a `coder.CellType` object for a homogeneous cell array.

If you use `coder.cstructname` to specify a name for the structure type that represents `t` in the generated code, you cannot create a homogeneous `coder.CellType` object from `t`.

The classification as homogeneous is permanent. You cannot later create a heterogeneous `coder.CellType` object from `newt`.

`t = makeHomogeneous(t)` creates a homogeneous `coder.CellType` object from `t` and replaces `t` with the new object.

Examples

Replace a Heterogeneous Cell Array Type with a Homogeneous Cell Array Type

Create a cell array type `t` whose elements have the same class, but different sizes.

```
t = coder.typeof({1 [2 3]})
```

```
t =

coder.CellType
   1x2 heterogeneous cell
      f0: 1x1 double
      f1: 1x2 double
```

The cell array type is heterogeneous.

Replace `t` with a cell array type for a homogeneous cell array.

```
t = makeHomogeneous(t)
```

```
t =

coder.CellType
   1x2 homogeneous cell
      base: 1x:2 double
```

The new cell array type is homogeneous.

Tips

- `coder.typeof` determines whether the cell array type is homogeneous or heterogeneous. If the cell array elements have the same class and size, `coder.typeof` returns a homogeneous cell array type. If the elements have different classes, `coder.typeof` returns a heterogeneous cell array type. For some cell arrays, the classification as homogeneous or heterogeneous is ambiguous. For example, the type for {1 [2 3]} can be a 1x2 heterogeneous type. The first element is double and the second element is 1x2 double. The type can also be a 1x3 homogeneous type in which the elements have class double and size 1x:2. For these ambiguous cases, `coder.typeof` uses heuristics to classify the type as homogeneous or heterogeneous. If you want a different classification, use the `makeHomogeneous` or `makeHeterogeneous` methods.

See Also

`coder.cstructname` | `coder.newtype` | `coder.typeof`

More About

- “Homogeneous vs. Heterogeneous Cell Arrays”

Introduced in R2015b

coder.ExternalDependency.getDescriptiveName

Class: coder.ExternalDependency
Package: coder

Return descriptive name for external dependency

Syntax

```
extname = coder.ExternalDependency.getDescriptiveName(bldcfg)
```

Description

`extname = coder.ExternalDependency.getDescriptiveName(bldcfg)` returns the name that you want to associate with an "external dependency" on page 2-316. The code generation software uses the external dependency name for error messages.

Input Arguments

`bldcfg`

`coder.BuildConfig` object. Use `coder.BuildConfig` methods to get information about the "build context" on page 2-316

You can use this information when you want to return different names based on the build context.

Output Arguments

`extname`

External dependency name returned as a string.

Definitions

external dependency

External code interface represented by a class derived from a `coder.ExternalDependency` class. The external code can be a library, object files, or C/C++ source.

build context

Information used by the build process including:

- Target language
- Code generation target
- Target hardware
- Build toolchain

Examples

Return external dependency name

Define a method that always returns the same name.

```
function myextname = getDescriptiveName(~)
   myextname = 'MyLibrary'
end
```

Return external library name based on the code generation target

Define a method that uses the build context to determine the name.

```
function myextname = getDescriptiveName(context)
    if context.isMatlabHostTarget()
        myextname = 'MyLibary_MatlabHost';
    else
        myextname = 'MyLibrary_Local';
    end
end
```

coder.ExternalDependency.isSupportedContext

Class: coder.ExternalDependency
Package: coder

Determine if build context supports external dependency

Syntax

```
tf = coder.ExternalDependency.isSupportedContext(bldcfg)
```

Description

`tf = coder.ExternalDependency.isSupportedContext(bldcfg)` returns true (1) if you can use the "external dependency" on page 2-318 in the current "build context" on page 2-318 . You must provide this method in the class definition for a class that derives from `coder.ExternalDependency`.

If you cannot use the "external dependency" on page 2-318 in the current "build context" on page 2-318, display an error message and stop code generation. The error message must describe why you cannot use the external dependency in this build context. If the method returns false (0), the code generation software uses a default error message. The default error message uses the name returned by the `getDescriptiveName` method of the `coder.ExternalDependency` class.

Use `coder.BuildConfig` methods to determine if you can use the external dependency in the current build context.

Input Arguments

`bldcfg`

`coder.BuildConfig` object. Use `coder.BuildConfig` methods to get information about the "build context" on page 2-318.

Output Arguments

`tf`

Value is true (1) if the build context supports the external dependency.

Definitions

external dependency

External code interface represented by a class derived from `coder.ExternalDependency` class. The external code can be a library, object file, or C/ C++ source.

build context

Information used by the build process including:

- Target language
- Code generation target
- Target hardware
- Build toolchain

Examples

Report error when build context does not support external library

This method returns true(1) if the code generation target is a MATLAB host target. Otherwise, the method reports an error and stops code generation.

Write `isSupportedContext` method.

```
function tf = isSupportedContext(ctx)
    if  ctx.isMatlabHostTarget()
        tf = true;
    else
```

```
            error('adder library not available for this target');
        end
    end
```

coder.ExternalDependency.updateBuildInfo

Class: coder.ExternalDependency
Package: coder

Update build information

Syntax

```
coder.ExternalDependency.updateBuildInfo(buildInfo, bldcfg)
```

Description

`coder.ExternalDependency.updateBuildInfo(buildInfo, bldcfg)` updates the build information object whose handle is `buildInfo`. After code generation, the build information object has standard information. Use this method to provide additional information required to link to external code. Use `coder.BuildConfig` methods to get information about the "build context" on page 2-321.

You must provide this method in the class definition for a class that derives from `coder.ExternalDependency`.

Input Arguments

`buildInfo`

Handle of build information object.

`bldcfg`

`coder.BuildConfig` object. Use `coder.BuildConfig` methods to get information about the "build context" on page 2-321.

Definitions

build context

Information used by the build process including:

- Target language
- Code generation target
- Target hardware
- Build toolchain

More About

- “Build Information Object”
- “Build Information Methods”

addDesignRangeSpecification

Class: coder.FixptConfig
Package: coder

Add design range specification to parameter

Syntax

```
addDesignRangeSpecification(fcnName,paramName,designMin, designMax)
```

Description

`addDesignRangeSpecification(fcnName,paramName,designMin, designMax)` specifies the minimum and maximum values allowed for the parameter, `paramName`, in function, `fcnName`. The fixed-point conversion process uses this design range information to derive ranges for downstream variables in the code.

Input Arguments

`fcnName` — Function name
string

Function name, specified as a string.

Data Types: `char`

`paramName` — Parameter name
string

Parameter name, specified as a string.

Data Types: `char`

`designMin` — Minimum value allowed for this parameter
scalar

Minimum value allowed for this parameter, specified as a scalar double.

Data Types: `double`

`designMax` — Maximum value allowed for this parameter
scalar

Maximum value allowed for this parameter, specified as a scalar double.

Data Types: `double`

Examples

Add a Design Range Specification

```
% Set up the fixed-point configuration object
fixptcfg = coder.config('fixpt');
fixptcfg.TestBenchName = 'dti_test';
fixptcfg.addDesignRangeSpecification('dti', 'u_in', -1.0, 1.0)
fixptcfg.ComputeDerivedRanges = true;

%Set up C code configuration object
cfg = coder.config('lib');
% Derive ranges  and generate fixed-point C code
codegen -config cfg -float2fixed fixptcfg dti -report
```

See Also

coder.FixptConfig | coder.FixptConfig.hasDesignRangeSpecification | coder.FixptConfig.removeDesignRangeSpecification | coder.FixptConfig.clearDesignRangeSpecifications | coder.FixptConfig.getDesignRangeSpecification | `codegen`

addFunctionReplacement

Class: coder.FixptConfig
Package: coder

Replace floating-point function with fixed-point function during fixed-point conversion

Syntax

```
addFunctionReplacement(floatFn,fixedFn)
```

Description

`addFunctionReplacement(floatFn,fixedFn)` specifies a function replacement in a `coder.FixptConfig` object. During floating-point to fixed-point conversion, the conversion process replaces the specified floating-point function with the specified fixed-point function. The fixed-point function must be in the same folder as the floating-point function or on the MATLAB path.

Input Arguments

`floatFn` — Name of floating-point function
`''` (default) | string

Name of floating-point function, specified as a string.

`fixedFn` — Name of fixed-point function
`''` (default) | string

Name of fixed-point function, specified as a string.

Examples

Specify Function Replacement in Fixed-Point Conversion Configuration Object

Suppose that:

- The function `myfunc` calls a local function `myadd`.
- The test function `mytest` calls `myfunc`.
- You want to replace calls to `myadd` with the fixed-point function `fi_myadd`.

Create a `coder.FixptConfig` object, `fixptcfg`, with default settings.

```
fixptcfg = coder.config('fixpt');
```

Set the test bench name. In this example, the test bench function name is `mytest`.

```
fixptcfg.TestBenchName = 'mytest';
```

Specify that the floating-point function, `myadd`, should be replaced with the fixed-point function, `fi_myadd`.

```
fixptcfg.addFunctionReplacement('myadd', 'fi_myadd');
```

Create a code generation configuration object to generate a standalone C static library.

```
cfg = coder.config('lib');
```

Convert the floating-point MATLAB function, `myfunc`, to fixed-point, and generate C code.

```
codegen -float2fixed fixptcfg -config cfg myfunc
```

When you generate code, the code generation software replaces instances of `myadd` with `fi_myadd` during floating-point to fixed-point conversion.

See Also

`codegen` | `coder.config` | coder.FixptConfig

clearDesignRangeSpecifications

Class: coder.FixptConfig
Package: coder

Clear all design range specifications

Syntax

```
clearDesignRangeSpecifications()
```

Description

`clearDesignRangeSpecifications()` clears all design range specifications.

Examples

Clear a Design Range Specification

```
% Set up the fixed-point configuration object
cfg = coder.config('fixpt');
cfg.TestBenchName = 'dti_test';
cfg.addDesignRangeSpecification('dti', 'u_in', -1.0, 1.0)
cfg.ComputeDerivedRanges = true;
% Verify that the 'dti' function parameter 'u_in' has design range
hasDesignRanges = cfg.hasDesignRangeSpecification('dti','u_in')
% Now remove the design range
cfg.clearDesignRangeSpecifications()
hasDesignRanges = cfg.hasDesignRangeSpecification('dti','u_in')
```

See Also

coder.FixptConfig | coder.FixptConfig.addDesignRangeSpecification
| coder.FixptConfig.removeDesignRangeSpecification
| coder.FixptConfig.hasDesignRangeSpecification |
coder.FixptConfig.getDesignRangeSpecification | `codegen`

getDesignRangeSpecification

Class: coder.FixptConfig
Package: coder

Get design range specifications for parameter

Syntax

```
[designMin, designMax] = getDesignRangeSpecification(fcnName,
paramName)
```

Description

`[designMin, designMax] = getDesignRangeSpecification(fcnName, paramName)` gets the minimum and maximum values specified for the parameter, `paramName`, in function, `fcnName`.

Input Arguments

`fcnName` — Function name
string

Function name, specified as a string.

Data Types: `char`

`paramName` — Parameter name
string

Parameter name, specified as a string.

Data Types: `char`

Output Arguments

`designMin` — Minimum value allowed for this parameter
scalar

Minimum value allowed for this parameter, specified as a scalar double.

Data Types: double

designMax — Maximum value allowed for this parameter
scalar

Maximum value allowed for this parameter, specified as a scalar double.

Data Types: double

Examples

Get Design Range Specifications

```
% Set up the fixed-point configuration object
cfg = coder.config('fixpt');
cfg.TestBenchName = 'dti_test';
cfg.addDesignRangeSpecification('dti', 'u_in', -1.0, 1.0)
cfg.ComputeDerivedRanges = true;
% Get the  design range for the 'dti' function parameter 'u_in'
[designMin, designMax] = cfg.getDesignRangeSpecification('dti','u_in')
```

```
designMin =

    -1


designMax =

     1
```

See Also

coder.FixptConfig | coder.FixptConfig.addDesignRangeSpecification | coder.FixptConfig.hasDesignRangeSpecification | coder.FixptConfig.removeDesignRangeSpecification | coder.FixptConfig.clearDesignRangeSpecifications | `codegen`

hasDesignRangeSpecification

Class: coder.FixptConfig
Package: coder

Determine whether parameter has design range

Syntax

```
hasDesignRange = hasDesignRangeSpecification(fcnName,paramName)
```

Description

`hasDesignRange = hasDesignRangeSpecification(fcnName,paramName)` returns true if the parameter, `param_name` in function, `fcn`, has a design range specified.

Input Arguments

`fcnName` — Name of function
string

Function name, specified as a string.

Example: ‘dti’

Data Types: `char`

`paramName` — Parameter name
string

Parameter name, specified as a string.

Example: ‘dti’

Data Types: `char`

Output Arguments

`hasDesignRange` — Parameter has design range

true | false

Parameter has design range, returned as a boolean.

Data Types: `logical`

Examples

Verify That a Parameter Has a Design Range Specification

```
% Set up the fixed-point configuration object
cfg = coder.config('fixpt');
cfg.TestBenchName = 'dti_test';
cfg.addDesignRangeSpecification('dti', 'u_in', -1.0, 1.0);
cfg.ComputeDerivedRanges = true;
% Verify that the 'dti' function parameter 'u_in' has design range
hasDesignRanges = cfg.hasDesignRangeSpecification('dti','u_in')
```

```
hasDesignRanges =

     1
```

See Also

coder.FixptConfig | coder.FixptConfig.addDesignRangeSpecification | coder.FixptConfig.removeDesignRangeSpecification | coder.FixptConfig.clearDesignRangeSpecifications | coder.FixptConfig.getDesignRangeSpecification | `codegen`

removeDesignRangeSpecification

Class: coder.FixptConfig
Package: coder

Remove design range specification from parameter

Syntax

`removeDesignRangeSpecification(fcnName,paramName)`

Description

`removeDesignRangeSpecification(fcnName,paramName)` removes the design range information specified for parameter, `paramName`, in function, `fcnName`.

Input Arguments

`fcnName` — Name of function
string

Function name, specified as a string.

Data Types: `char`

`paramName` — Parameter name
string

Parameter name, specified as a string.

Data Types: `char`

Examples

Remove Design Range Specifications

```
% Set up the fixed-point configuration object
```

```
cfg = coder.config('fixpt');
cfg.TestBenchName = 'dti_test';
cfg.addDesignRangeSpecification('dti', 'u_in', -1.0, 1.0)
cfg.ComputeDerivedRanges = true;
% Verify that the 'dti' function parameter 'u_in' has design range
hasDesignRanges = cfg.hasDesignRangeSpecification('dti','u_in')
% Now clear the design ranges and verify that
% hasDesignRangeSpecification returns false
cfg.removeDesignRangeSpecification('dti', 'u_in')
hasDesignRanges = cfg.hasDesignRangeSpecification('dti','u_in')
```

See Also

coder.FixptConfig | coder.FixptConfig.addDesignRangeSpecification | coder.FixptConfig.clearDesignRangeSpecifications | coder.FixptConfig.hasDesignRangeSpecification | coder.FixptConfig.getDesignRangeSpecification | `codegen`

addApproximation

Replace floating-point function with lookup table during fixed-point conversion

Syntax

```
addApproximation(approximationObject)
```

Description

`addApproximation(approximationObject)` specifies a lookup table replacement in a `coder.FixptConfig` object. During floating-point to fixed-point conversion, the conversion process generates a lookup table approximation for the function specified in the `approximationObject`.

Input Arguments

`approximationObject` — Function replacement configuration object
`coder.mathfcngenerator.LookupTable` configuration object

Function replacement configuration object. Use the `coder.FixptConfig` configuration object `addApproximation` method to associate this configuration object with a `coder.FixptConfig` object. Then use the `codegen` function `-float2fixed` option with `coder.FixptConfig` to convert floating-point MATLAB code to fixed-point code.

Examples

Replace log function with an optimized lookup table replacement

Create a function replacement configuration object that specifies to replace the log function with an optimized lookup table.

```
logAppx = coder.approximation('Function','log','OptimizeLUTSize',...
          true,'InputRange',[0.1,1000],'InterpolationDegree',1,...
          'ErrorThreshold',1e-3,...
          'FunctionNamePrefix','log_optim_','OptimizeIterations',25);
```

Create a fixed-point configuration object and associate the function replacement configuration object with it.

```
fixptcfg = coder.config('fixpt');
fixptcfg.addApproximation(logAppx);
```

You can now generate fixed-point code using the `codegen` function.

- “Replace the exp Function with a Lookup Table”
- “Replace a Custom Function with a Lookup Table”

See Also

`codegen` | `coder.config` | coder.FixptConfig

More About

- “Replacing Functions Using Lookup Table Approximations”

addFunctionReplacement

Class: coder.SingleConfig
Package: coder

Replace double-precision function with single-precision function during single-precision conversion

Syntax

```
addFunctionReplacement(doubleFn,singleFn)
```

Description

`addFunctionReplacement(doubleFn,singleFn)` specifies a function replacement in a `coder.SingleConfig` object. During double-precision to single-precision conversion, the conversion process replaces the specified double-precision function with the specified single-precision function. The single-precision function must be in the same folder as the double-precision function or on the MATLAB path. It is a best practice to provide unique names to local functions that a replacement function calls. If a replacement function calls a local function, do not give that local function the same name as a local function in a different replacement function file.

Input Arguments

`doubleFn` — Name of double-precision function
`''` (default) | string

Name of double-precision function, specified as a string.

`singleFn` — Name of single-precision function
`''` (default) | string

Name of single-precision function, specified as a string.

Examples

Specify Function Replacement in Single-Precision Conversion Configuration Object

Suppose that:

- The function `myfunc` calls a local function `myadd`.
- The test function `mytest` calls `myfunc`.
- You want to replace calls to `myadd` with the single-precision function `single_myadd`.

Create a `coder.SingleConfig` object, `scfg`, with default settings.

```
scfg = coder.config('single');
```

Set the test file name. In this example, the test file function name is `mytest`.

```
scfg.TestBenchName = 'mytest';
```

Specify that you want to replace the double-precision function, `myadd`, with the single-precision function, `single_myadd`.

```
scfg.addFunctionReplacement('myadd', 'single_myadd');
```

Convert the double-precision MATLAB function, `myfunc`, to a single-precision MATLAB function.

```
codegen -double2single scfg myfunc
```

The double-precision to single-precision conversion replaces instances of `myadd` with `single_myadd`.

See Also
`codegen` | `coder.config`

Introduced in R2015b

Class Reference

coder.ArrayType class

Package: coder
Superclasses: coder.Type

Represent set of MATLAB arrays

Description

Specifies the set of arrays that the generated code accepts. Use only with the `codegen -args` option. Do not pass as an input to a generated MEX function.

Construction

`coder.ArrayType` is an abstract class. You cannot create instances of it directly. You can create `coder.EnumType`, `coder.FiType`, `coder.PrimitiveType`, and `coder.StructType` objects that derive from this class.

Properties

`ClassName`

Class of values in this set

`SizeVector`

The upper-bound size of arrays in this set.

`VariableDims`

A vector specifying whether each dimension of the array is fixed or variable size. If a vector element is `true`, the corresponding dimension is variable size.

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

See Also

coder.EnumType | coder.FiType | coder.PrimitiveType | coder.StructType | coder.CellType | `coder.resize` | coder.Type | `coder.newtype` | `coder.typeof` | `codegen`

coder.BuildConfig class

Package: coder

Build context during code generation

Description

The code generation software creates an object of this class to facilitate access to the *build context*. The build context encapsulates the settings used by the code generation software including:

- Target language
- Code generation target
- Target hardware
- Build toolchain

Use `coder.BuildConfig` methods in the methods that you write for the `coder.ExternalDependency` class.

Construction

The code generation software creates objects of this class.

Methods

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Use `coder.BuildConfig` methods to access the build context in `coder.ExternalDependency` methods

This example shows how to use `coder.BuildConfig` methods to access the build context in `coder.ExternalDependency` methods. In this example, you use:

- `coder.BuildConfig.isMatlabHostTarget` to verify that the code generation target is the MATLAB host. If the host is not MATLAB report an error.
- `coder.BuildConfig.getStdLibInfo` to get the link-time and run-time library file extensions. Use this information to update the build information.

Write a class definition file for an external library that contains the function `adder`.

```
%================================================================
% This class abstracts the API to an external Adder library.
% It implements static methods for updating the build information
% at compile time and build time.
%================================================================

classdef AdderAPI < coder.ExternalDependency
    %#codegen

    methods (Static)

        function bName = getDescriptiveName(~)
            bName = 'AdderAPI';
        end

        function tf = isSupportedContext(ctx)
            if  ctx.isMatlabHostTarget()
                tf = true;
            else
                error('adder library not available for this target');
            end
        end

        function updateBuildInfo(buildInfo, ctx)
            [~, linkLibExt, execLibExt, ~] = ctx.getStdLibInfo();

            % Header files
            hdrFilePath = fullfile(pwd, 'codegen', 'dll', 'adder');
            buildInfo.addIncludePaths(hdrFilePath);

            % Link files
            linkFiles = strcat('adder', linkLibExt);
            linkPath = hdrFilePath;
            linkPriority = '';
            linkPrecompiled = true;
            linkLinkOnly = true;
            group = '';
            buildInfo.addLinkObjects(linkFiles, linkPath, ...
                linkPriority, linkPrecompiled, linkLinkOnly, group);

            % Non-build files
            nbFiles = 'adder';
            nbFiles = strcat(nbFiles, execLibExt);
            buildInfo.addNonBuildFiles(nbFiles,'','');
        end

        %API for library function 'adder'
        function c = adder(a, b)
            if coder.target('MATLAB')
                % running in MATLAB, use built-in addition
                c = a + b;
            else
                % running in generated code, call library function
                coder.cinclude('adder.h');

                % Because MATLAB Coder generated adder, use the
                % housekeeping functions before and after calling
                % adder with coder.ceval.
                % Call initialize function before calling adder for the
                % first time.

                coder.ceval('adder_initialize');
                c = 0;
                c = coder.ceval('adder', a, b);


                % Call the terminate function after
                % calling adder for the last time.

                coder.ceval('adder_terminate');
            end
        end
        end
end
```

See Also

coder.ExternalDependency | coder.HardwareImplementation | coder.make.ToolchainInfo | `coder.target`

coder.CellType class

Package: coder
Superclasses: coder.ArrayType

Represent set of MATLAB cell arrays

Description

Specifies the set of cell arrays that the generated code accepts. Use only with the `codegen -args` option. Do not pass as an input to a generated MEX function.

Construction

`t = coder.typeof(cells)` creates a `coder.CellType` object for a cell array that has the same cells and cell types as `cells`. The cells in `cells` are type objects or example values.

`t = coder.typeof(cells, sz, variable_dims)` creates a `coder.CellType` object that has upper bounds specified by `sz` and variable dimensions specified by `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is unbounded and the dimension is variable size. When `sz` is `[]`, the upper bounds do not change. If you do not specify the `variable_dims` input parameter, except for the unbounded dimensions, the dimensions of the type are fixed. A scalar `variable_dims` applies to the bounded dimensions that are not `1` or `0`.

When `cells` specifies a cell array whose elements have different classes, you cannot use `coder.typeof` to create a `coder.CellType` object for a variable-size cell array.

`t = coder.newtype(cells)` creates a `coder.CellType` object for a cell array that has the cells and cell types specified by `cells`. The cells in `cells` must be type objects.

`t = coder.newtype(cell_array, sz, variable_dims)` creates a `coder.CellType` that has upper bounds specified by `sz` and variable dimensions specified by `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is unbounded and the dimension is variable size. When `sz` is `[]`, the upper bounds do not change. If you do not specify the `variable_dims` input parameter, except for the unbounded dimensions, the dimensions of the type are fixed. A scalar `variable_dims` applies to the bounded dimensions that are not `1` or `0`.

When `cells` specifies a cell array whose elements have different classes, you cannot use `coder.newtype` to create a `coder.CellType` object for a variable-size cell array.

Input Arguments

`cells` — Specification of cell types

cell array

Cell array that specifies the cells and cell types for the output `coder.CellType` object. For `coder.typeof`, `cells` can contain type objects or example values. For `coder.newtype`, `cells` must contain type objects.

`sz` — Size of cell array

row vector of integer values

Specifies the upper bound for each dimension of the cell array type object. For `coder.newtype`, `sz` cannot change the number of cells for a heterogeneous cell array.

For `coder.newtype`, the default is `[1 1]`.

`variable_dims` — Dimensions that are variable size

row vector of logical values

Specifies whether each dimension is variable size (true) or fixed size (false).

For `coder.newtype`, the default is `true` for dimensions for which `sz` specifies an upper bound of `inf` and `false` for all other dimensions.

When `cells` specifies a cell array whose elements have different classes, you cannot create a `coder.CellType` object for a variable-size cell array.

Properties

`Alignment` — Run-time memory alignment

`-1` | power of `2` that is less than or equal to `128`

The run-time memory alignment of structures of this type in bytes. If you have an Embedded Coder license and use Code Replacement Libraries (CRLs), the CRLs provide the ability to align data objects passed into a replacement function to a specified boundary. You can take advantage of target-specific function implementations that require data to be aligned. By default, the structure is not aligned on a specific boundary, so it is not matched by CRL functions that require alignment.

`Cells` — Types of cells
cell array

A cell array that specifies the `coder.Type` of each cell.

`ClassName` — Name of class
string

Class of values in this set.

`Extern` — External definition
logical scalar

Specifies whether the cell array type is externally defined.

`HeaderFile` — Name of header file
string

If the cell array type is externally defined, the name of the header file that contains the external definition of the type, for example, `'mytype.h'`. If you use the `codegen` command to specify the path to the file, use the `-I` option. If you use the MATLAB Coder app to specify the path to the file, use the **Additional include directories** setting in the **Custom Code** tab in the project settings dialog box.

By default, the generated code contains `#include` statements for custom header files after the standard header files. If a standard header file refers to the custom structure type, then the compilation fails. If you specify the `HeaderFile` option, the code generation software includes the custom header file where it is required.

Must be a nonempty string.

`SizeVector` — Size of cell array
row vector of integer values

The upper bounds of dimensions of the cell array.

`TypeName` — Name of generated structure type
string

The name to use in the generated code for the structure type that represents this cell array type. `TypeName` applies only to heterogeneous cell arrays types.

`VariableDims` — Dimensions that are variable size
row vector of logical values

A vector that specifies whether each dimension of the array is fixed or variable size. If a vector element is `true`, the corresponding dimension is variable size.

Methods

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Create a Type for a Cell Array Whose Elements Have the Same Class

Create a type for a cell array whose first element has class char and whose second element has class double.

```
t = coder.typeof({1 2 3})
```

```
t =

coder.CellType
   1x3 homogeneous cell
      base: 1x1 double
```

The type is homogeneous.

Create a Heterogeneous Type for a Cell Array Whose Elements Have the Same Class

To create a heterogeneous type when the elements of the example cell array type have the same class, use the `makeHeterogeneous` method.

```
t = makeHeterogeneous(coder.typeof({1 2 3}))
```

```
t =

coder.CellType
   1x3 heterogeneous cell
      f0: 1x1 double
      f1: 1x1 double
      f2: 1x1 double
```

The cell array type is heterogeneous. It is represented as a structure in the generated code.

Create a Cell Array Type for a Cell Array Whose Elements Have Different Classes

Define variables that are example cell values.

```
a = 'a';
b = 1;
```

Pass the example cell values to `coder.typeof`.

```
t = coder.typeof({a, b})
```

```
t =

coder.CellType
   1x2 heterogeneous cell
      f0: 1x1 char
      f1: 1x1 double
```

Create a Type for a Variable-Size Homogeneous Cell Array from an Example Cell Array Whose Elements Have Different Classes

Create a type for a cell array that has two strings with different sizes.

```
t = coder.typeof({'aa', 'bbb'})
```

```
t =

coder.CellType
   1x2 heterogeneous cell
      f0: 1x2 char
      f1: 1x3 char
```

The cell array type is heterogeneous.

Create a type using the same cell array input. This time, specify that the cell array type has variable-size dimensions.

```
t = coder.typeof({'aa','bbb'},[1,10],[0,1])
```

```
t =

coder.CellType
   1x:10 homogeneous cell
      base: 1x:3 char
```

The cell array type is homogeneous. `coder.typeof` determined that the base type `1x:3 char` can represent `'aa'`, and `'bbb'`.

Create a New Cell Array Type from a Cell Array of Types

Create a type for a scalar `int8`.

```
ta = coder.newtype('int8',[1 1]);
```

Create a type for a :1x:2 double row vector.

```
tb = coder.newtype('double',[1 2],[1 1]);
```

Create a cell array type whose cells have the types specified by `ta` and `ta`.

```
t = coder.newtype('cell',{ta,tb})
```

```
t =

coder.CellType
   1x2 heterogeneous cell
      f0: 1x1 int8
      f1: :1x:2 double
```

Create a `coder.CellType` That Uses an Externally Defined Type

Create a cell type for a heterogeneous cell array.

```
ca = coder.typeof(double(0));
cb = coder.typeof(single(0));
t = coder.typeof({ca cb})
```

```
coder.CellType
   1x2 heterogeneous cell
      f0: 1x1 double
      f1: 1x1 single
```

Use `coder.structname` to specify the name for the type and that the type is defined in an external file.

```
t = coder.cstructname(t,'mytype','extern','HeaderFile','myheader.h')
```

```
t =

coder.CellType
   1x2 extern heterogeneous cell mytype(myheader.h)
      f0: 1x1 double
      f1: 1x1 single
```

Tips

- `coder.typeof` determines whether the cell array type is homogeneous or heterogeneous. If the cell array elements have the same class and size, `coder.typeof` returns a homogeneous cell array type. If the elements have different classes, `coder.typeof` returns a heterogeneous cell array type. For some cell arrays, the classification as homogeneous or heterogeneous is ambiguous. For example, the type for {1 [2 3]} can be a 1x2 heterogeneous type. The first element is double and the second element is 1x2 double. The type can also be a 1x3 homogeneous type in which the elements have class double and size 1x:2. For these ambiguous cases, `coder.typeof` uses heuristics to classify the type as homogeneous or heterogeneous. If you want a different classification, use the `makeHomogeneous` or `makeHeterogeneous` methods. The `makeHomogeneous` method makes a homogeneous copy of a type. The `makeHeterogeneous` method makes a heterogeneous copy of a type.

  The `makeHomogeneous` and `makeHeterogeneous` methods permanently assign the classification as homogeneous and heterogeneous, respectively. You cannot later use one of these methods to create a copy that has a different classification.

See Also

coder.ArrayType | coder.Constant | coder.EnumType | coder.FiType | coder.PrimitiveType | coder.StructType | coder.Type | `codegen` | `coder.newtype` | `coder.resize` | `coder.typeof`

Introduced in R2015b

coder.CodeConfig class

Package: coder

`codegen` configuration object

Description

A `coder.CodeConfig` object contains the configuration parameters that the `codegen` function requires to generate standalone C/C++ libraries and executables. Use the `-config` option to pass this object to the `codegen` function.

Construction

`cfg = coder.config('lib')` creates a code generation configuration object for C/C++ static library generation. If the Embedded Coder product is not installed, it creates a `coder.CodeConfig` object. Otherwise, it creates a `coder.EmbeddedCodeConfig` object.

`cfg = coder.config('dll')` creates a code generation configuration object for C/C++ dynamic library generation. If the Embedded Coder product is not installed, it creates a `coder.CodeConfig` object. Otherwise, it creates a `coder.EmbeddedCodeConfig` object.

`cfg = coder.config('exe')` creates a code generation configuration object for C/C++ executable generation. If the Embedded Coder product is not installed, it creates a `coder.CodeConfig` object. Otherwise, it creates a `coder.EmbeddedCodeConfig` object.

`cfg = coder.config(output_type, 'ecoder', false)` creates a `coder.CodeConfig` object for the specified output type even if the Embedded Coder product is installed.

`cfg = coder.config(output_type, 'ecoder', true)` creates a `coder.EmbeddedCodeConfig` object for the specified output type even if the Embedded Coder product is not installed. However, you cannot generate code using a `coder.EmbeddedCodeConfig` object unless an Embedded Coder license is available.

Properties

`BuildConfiguration`

Specify build configuration. `'Faster Builds'`, `'Faster Runs'`, `'Debug'`, `'Specify'`.

Default: *`string`*, `'Faster Builds'`

`CodeReplacementLibrary`

Specify an application-specific math library for the generated code.

Value	Description
`'None'`	Does not use a code replacement library.
`'GNU C99 extensions'`	Generates calls to the GNU® gcc math library, which provides C99 extensions as defined by compiler option `-std=gnu99`.
`'Intel IPP for x86-64 (Windows)'`	Generates calls to the Intel Performance Primitives (IPP) library for the x86-64 Windows platform.
`'Intel IPP/SSE with GNU99 extensions for x86-64 (Windows)'`	Generates calls to the GNU libraries for Intel Performance Primitives (IPP) and Streaming SIMD Extensions (SSE), with GNU C99 extensions, for the x86-64 Windows platform.
`'Intel IPP for x86/Pentium (Windows)'`	Generates calls to the Intel Performance Primitives (IPP) library for the x86/ Pentium Windows platform.
`'Intel IPP/SSE with GNU99 extensions for x86/Pentium (Windows)'`	Generates calls to the GNU libraries for Intel Performance Primitives (IPP) and Streaming SIMD Extensions (SSE), with GNU C99 extensions, for the x86/Pentium Windows platform.
`'Intel IPP for x86-64 (Linux)'`	Generates calls to the Intel Performance Primitives (IPP) library for the x86-64 Linux platform.

Value	Description
`'Intel IPP/SSE with GNU99 extensions for x86-64 (Linux)'`	Generates calls to the GNU libraries for Intel Performance Primitives (IPP) and Streaming SIMD Extensions (SSE), with GNU C99 extensions, for the x86-64 Linux platform.

Compatible libraries depend on these parameters:

- `TargetLang`
- `TargetLangStandard`
- `ProdHWDeviceType` in the hardware implementation configuration object.

Embedded Coder offers more libraries and the ability to create and use custom code replacement libraries.

MATLAB Coder generates the minimal set of `#include` statements for header files required by the selected code replacement library.

Before setting this parameter, verify that your compiler supports the library that you want to use. If you select a parameter value that your compiler does not support, compiler errors can occur.

Note: MATLAB Coder software does not support TLC callbacks.

Default: *`string`*, `'None'`

`ConstantFoldingTimeout`

Specify the maximum number of instructions that the constant folder will execute before stopping. In some situations, code generation might require specific instructions to be constant. Increase this value if code generation is failing.

Default: *`integer`*, `10000`

`CustomHeaderCode`

Specify code to appear near the top of each C/C++ header file generated from your MATLAB algorithm code.

Default: *`string`*, `''`

`CustomInclude`

Specify a space-separated list of include folders to add to the include path when compiling the generated code.

If your list includes Windows path strings that contain spaces, enclose each instance in double quotes within the argument string, for example:

```
'C:\Project "C:\Custom Files"'
```

Default: *`string`*, `''`

`CustomInitializer`

Specify code to appear in the initialize function of the generated `.c` or `.cpp` file.

Default: *`string`*, `''`

`CustomLibrary`

Specify a space-separated list of static library or object files to link with the generated code.

Default: *`string`*, `''`

`CustomSource`

Specify a space-separated list of source files to compile and link with the generated code.

Default: *`string`*, `''`

`CustomSourceCode`

Specify code to appear near the top of the generated `.c` or `.cpp` file, outside of a function.

Default: *`string`*, `''`

`CustomTerminator`

Specify code to appear in the terminate function of the generated `.c` or `.cpp` file.

Default: *`string`*, `''`

CustomToolchainOptions

Specify custom settings for each tool in the selected toolchain, as a cell array.

Dependencies:

- `Toolchain` determines which tools and options appear in the cell.
- Setting `BuildConfiguration` to `Specify` enables the options specified by `CustomToolchainOptions`.

Start by getting the current options and values. For example:

```
rtwdemo_sil_topmodel;
set_param(gcs, 'BuildConfiguration', 'Specify')
opt = get_param(gcs, 'CustomToolchainOptions')
```

Then edit the values in `opt`.

These values derive from the toolchain definition file and the third-party compiler options. See “Custom Toolchain Registration”.

Default: *`cell array`*

DataTypeReplacement

Specify whether to use built-in C data types or pre-defined types from `rtwtypes.h` in generated code.

Set to `'CoderTypeDefs'` to use the data types from `rtwtypes.h`. Otherwise, to use built-in C data types, retain default value or set to `'CBuiltIn'`.

Default: *`string`*, `'CBuiltIn'`

Description

Description of the `coder.CodeConfig` object.

Default: *`string`*, `'class CodeConfig: C code generation configuration.'`

DynamicMemoryAllocation

Control use of dynamic memory allocation for variable-size data.

By default, dynamic memory allocation is enabled for variable-size arrays whose size (in bytes) is greater than or equal to `DynamicMemoryAllocationThreshold`. `codegen` allocates memory for this variable-size data dynamically on the heap.

Set this property to `'Off'` to allocate memory statically on the stack. Set it to `'AllVariableSizeArrays'` to allocate memory for all variable-size arrays dynamically on the heap. You **must** use dynamic memory allocation for unbounded variable-size data.

Dependencies:

- `EnableVariableSizing` enables this parameter.
- Setting this parameter to `'Threshold'` enables the `DynamicMemoryAllocationThreshold` parameter.

Default: *`string`*, `'Threshold'`

`DynamicMemoryAllocationThreshold`

Specify the size threshold in bytes.`codegen` allocates memory on the heap for variable-size arrays whose size is greater than or equal to this threshold.

Dependency:

- Setting `DynamicMemoryAllocation` to `'Threshold'` enables this parameter.

Default: *`integer`*, `65536`

`EnableAutoExtrinsicCalls`

Specify whether MATLAB Coder must automatically treat common visualization functions as extrinsic functions. When this option is enabled, MATLAB Coder detects calls to many common visualization functions, such as `plot`, `disp`, and `figure`. For MEX code generation, MATLAB Coder automatically calls out to MATLAB for these functions. For standalone code generation, MATLAB Coder does not generate code for these visualization functions. This capability reduces the amount of time that you spend making your code suitable for code generation. It also removes the requirement to declare these functions extrinsic using the `coder.extrinsic` function.

Default: `true`

`EnableMemcpy`

Optimize code generated for vector assignment by replacing for-loops with `memcpy`. Enables use of `memcpy` for vector assignment based on the associated threshold parameter `MemcpyThreshold`. If the number of array elements times the number of bytes per element is greater than or equal to the specified value for `MemcpyThreshold`, the generated code uses `memcpy`. One byte equals the width of a C/C++ character in this context.

Dependency:

- This parameter enables the associated parameter `MemcpyThreshold`.

Default: `true`

`EnableOpenMP`

If possible, enable OpenMP. Using the OpenMP library, the C/C++ code that MATLAB Coder generates for `parfor`-loops can run on multiple threads. With OpenMP disabled, MATLAB Coder treats `parfor`-loops as for-loops and generates C/C++ code that runs on a single thread.

Default: `true`

`EnableVariableSizing`

Enable support for variable-size arrays.

Dependency:

- This parameter enables the parameter `DynamicMemoryAllocation`.

Default: `true`

`FilePartitionMethod`

Specify whether to generate one C/C++ file for each MATLAB language file (`'MapMFileToCFile'`) or generate all C/C++ functions into a single file (`'SingleFile'`).

Default: *`string`*, `'MapMFileToCFile'`

`GenCodeOnly`

Specify code generation versus an executable or static library build.

Default: `false`

`GenerateComments`

Place comments in the generated files.

Dependency:

- Enables `MATLABSourceComments`.

Default: `true`

`GenerateExampleMain`

Specify whether to generate an example C/C++ main function. If example main generation is enabled, MATLAB Coder generates source and header files for the main function in the `examples` subfolder of the build folder. For C code generation, it generates the files `main.c` and `main.h`. For C++ code generation, it generates the files `main.cpp` and `main.h`.

The example main function declares and initializes data. It calls entry-point functions but does not use values returned from the entry-point functions.

Before you use the example main files, copy them to another location and modify them to meet the requirements of your application.

Value	Description
`'DoNotGenerate'`	Does not generate an example C/C++ main function.
`'GenerateCodeOnly'`	Generates an example C/C++ main function but does not compile it.
`'GenerateCodeAndCompile'`	Generates an example C/C++ main function and compiles it to create a test executable. This executable does not return output. If the `GenCodeOnly` parameter is `true`, MATLAB Coder does not compile the C/C++ main function.

Default: *`string`*, `'GenerateCodeOnly'`

`GenerateMakefile`

Specify whether to generate a makefile during the build process.

Default: `true`

`GenerateReport`

Document generated code in an HTML report.

Default: `false`

`HardwareImplementation`

Handle to `coder.HardwareImplementation` object that specifies hardware-specific configuration parameters for C/C++ code generation.

Use `coder.HardwareImplementation` to create the `coder.HardwareImplementation` object. For example:

```
cfg = coder.config('lib');
hw_cfg = coder.HardwareImplementation;
cfg.HardwareImplementation = hw_cfg;
```

If `HardwareImplementation` is empty, the code generation software uses the settings for the MATLAB host computer.

`InitFltsAndDblsToZero`

Specify whether to generate code that explicitly initializes floating-point data to 0.0.

Default: `true`

`InlineStackLimit`

Specify the stack size limit on inlined functions. This specification determines the amount of stack space allocated for local variables of the inlined function.

Specifying a limit on the stack space constrains the amount of inlining allowed. For out-of-line functions, stack space for variables local to the function is released when the function returns. However, for inlined functions, stack space remains occupied by the local variables even when the function returns.

This feature is especially important for embedded processors, where stack size can be limited.

Default: *`integer`*, `4000`

`InlineThreshold`

Specify function size for inline threshold. Unless there are conflicts with other inlining conditions, MATLAB Coder inlines functions that are smaller than this size.

The function size is measured in terms of an abstract number of instructions, not actual MATLAB instructions or instructions in the target processor. You must experiment with this parameter to obtain the inlining behavior that you want. For instance, if the default setting for this parameter is leading to large functions being inlined and in turn generating large C code, you can tune the parameter in steps until you are satisfied with the size of generated code.

Default: *`integer`*, `10`

`InlineThresholdMax`

Specify the maximum size of functions after inlining. If the size of the calling function after inlining exceeds `InlineThresholdMax`,MATLAB Coder does not inline the called function.

The function size is measured in terms of an abstract number of instructions, not actual MATLAB instructions or instructions in the target processor. You must experiment with this parameter to obtain the inlining behavior that you want. For instance, if the default setting for this parameter is leading to large functions being inlined and in turn generating large C code, you can tune the parameter in steps until you are satisfied with the size of generated code.

Default: *`integer`*, `200`

`LaunchReport`

Specify whether to display a report after code generation is complete or an error occurs.

Default: `true`

`MATLABSourceComments`

Include MATLAB source code as comments in the generated code.

Dependency:

- `GenerateComments` enables this parameter.

Default: `false`

`MaxIdLength`

Specify maximum number of characters in generated function, type definition, and variable names. To avoid truncation of identifiers by the target C compiler, specify a value that matches the maximum identifier length of the target C compiler.

This parameter does not apply to exported identifiers, such as the generated names for entry-point functions or emxArray API functions. If the length of an exported identifier exceeds the maximum identifier length of the target C compiler, the target C compiler truncates the exported identifier.

Minimum is 31. Maximum is 256.

Default: *`integer`*, `31`

`MemcpyThreshold`

Specify the minimum array size in bytes for which `memcpy` function calls must replace for loops in the generated code for nonscalar assignments.

Dependency:

- `EnableMemcpy` enables this parameter.

Default: *`integer`*, `64`

`MultiInstanceCode`

Generate reusable, multi-instance code that is reentrant.

Default: `false`

`Name`

Name of the configuration object.

Default: *`string`*, `'CodeConfig'`

`OutputType`

Specify whether to generate a standalone C/C++ static library, dynamic library, or executable. Set to `'LIB'` to generate a static library, `'DLL'` to generate a dynamic library, or `'EXE'` to generate an executable.

Default: *`string`*, `'LIB'`

`PassStructByReference`

Specify whether to pass structures by reference to entry-point functions. Set to `true` to pass structures by reference, which reduces memory usage and execution time by minimizing the number of copies of parameters at entry-point function boundaries. Set to `false` to pass structures by value.

This parameter applies only to entry-point functions.

If you set this parameter to `true`, an entry-point function that writes to a field of a structure parameter overwrites the input value.

Default: `true`

`PostCodeGenCommand`

Specify command to customize build processing after code generation using `codegen`.

Default: *`string`*, `''`

`PreserveVariableNames`

Specify the variable names that the variable reuse optimization must preserve.

Value	Description
`'UserNames'`	Preserve names that correspond to user-defined variables in the MATLAB code. For this option, the variable reuse optimization does not replace your variable name with another name and does not use your name for another variable. Use this option for readability. You can more easily trace the variables in the generated code back to the variables in your MATLAB code.

Value	Description
	The variable reuse optimization preserves your variable names, however, other optimizations can remove them from the generated code. MATLAB Coder does not reuse your variables in the generated C/C++ code, however, the C/C++ compiler can reuse these variables in the generated binary code.
`'None'`	The variable reuse optimization does not have to preserve any variable names. It can reuse any variables that meet the requirements for variable reuse. If your code uses large data structures or arrays, in some cases, the extra memory required to preserve your variable names can affect performance. In these cases, use this option to reduce memory usage or improve execution speed.
`'All'`	Preserve all variable names. This option disables variable reuse. Use this option only for testing or debugging. Do not use this option for production code.

Default: *`string`*, `'UserNames'`

`ReservedNameArray`

Enter a space-separated list of names that MATLAB Coder is not to use for naming functions or variables.

Default: *`string`*, `''`

`RuntimeChecks`

Enable run-time error detection and reporting in the generated C/C++ code. If you select this option, the generated code checks for errors such as out-of-bounds array indexing.

The error reporting software uses `fprintf` to write error messages to `stderr`. It uses `abort` to terminate the application. If `fprintf` and `abort` are not available, you must provide them. The `abort` function abruptly terminates the program. If your system supports signals, you can catch the abort signal (`SIGABRT`) so that you can control the program termination.

Error messages are in English.

Default: `false`

`SaturateOnIntegerOverflow`

Overflows saturate to either the minimum or maximum value that the data type can represent. Otherwise, the overflow behavior depends on your target C compiler. Most C compilers wrap on overflow.

This parameter applies only to MATLAB built-in integer types. It does not apply to doubles, singles, or fixed-point data types.

Default: `true`

`StackUsageMax`

Specify the maximum stack usage per application in bytes. Set a limit that is lower than the available stack size. Otherwise, a run-time stack overflow can occur. The C compiler detects and reports overflows.

Default: *`integer`*, `200000`

`SupportNonFinite`

Specify whether to generate nonfinite data and operations.

Default: `true`

`TargetLang`

Specify the target language. Set to `'C'` to generate C code. Set to `C++` to generate C++ code. If you specify C++, MATLAB Coder wraps the C code into .cpp files so that you can use a C++ compiler and interface with external C++ applications. It does not generate C+ + classes.

Default: *`string`*, `'C'`

`TargetLangStandard`

Specify a standard math library for the generated code. Options depend on the language selection. For C, `'C89/C90 (ANSI)'` or `'C99 (ISO)'`. For C++, `'C89/C90 (ANSI)'`, `'C99 (ISO)'`, or `'C++03 (ISO)'`.

Before setting this parameter, verify that your compiler supports the library that you want to use. If you select a parameter value that your compiler does not support, compiler errors can occur.

Default: *`string`*, `'C89/C90 (ANSI)'`

`Toolchain`

Specify the toolchain to use. If you do not specify a toolchain, MATLAB Coder automatically locates an installed toolchain.

Default: *`string`*, `'Automatically locate an installed toolchain'`

`Verbose`

Display code generation progress.

Default: `false`

Copy Semantics

Handle. To learn how handle classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Generate a standalone C/C++ static library from a MATLAB function that is suitable for code generation:

1 Write a MATLAB function, `coderand`, that generates a random scalar value from the standard uniform distribution on the open interval (0,1).

```
function r = coderand() %#codegen
% The directive %#codegen declares that the function
% is intended for code generation
r = rand();
```

2 Create a code generation configuration object to generate a static library.

```
cfg = coder.config('lib')
```

3 Generate the C library files in the default folder (codegen/lib/coderand). Use the `-config` option to specify the configuration object.

```
codegen -config cfg coderand
```

Generate a C executable file from a MATLAB function that is suitable for code generation. Specify the main C function as a configuration parameter.

1 Write a MATLAB function, `coderand`, that generates a random scalar value from the standard uniform distribution on the open interval (0,1).

```
function r = coderand() %#codegen
r = rand();
```

2 Write a main C function, c:\myfiles\main.c, that calls `coderand`.

```
/*
** main.c
*/
#include <stdio.h>
#include <stdlib.h>
#include "coderand.h"

int main()
{
    coderand_initialize();

    printf("coderand=%g\n", coderand());

    coderand_terminate();

    return 0;
}
```

3 Configure your code generation parameters to include the main C function, then generate the C executable.

```
cfg = coder.config('exe');
cfg.CustomSource = 'main.c';
cfg.CustomInclude = 'c:\myfiles';
```

```
codegen -config cfg coderand
```

`codegen` generates C executables and supporting files in the default folder `codegen/exe/coderand`.

This example shows how to specify a main function as a parameter in the configuration object `coder.CodeConfig`. Alternatively, you can specify the file containing main() separately on the command line. You can use a source, object, or library file.

Alternatives

Use the `coder` function to create a MATLAB Coder project. The project provides a user interface that facilitates adding MATLAB files, defining input parameters, and specifying build parameters.

See Also

`codegen` | `coder` | coder.EmbeddedCodeConfig

coder.Constant class

Package: coder
Superclasses: coder.Type

Represent set containing one MATLAB value

Description

Use a `coder.Constant` object to define values that are constant during code generation. Use only with the `codegen -args` options. Do not pass as an input to a generated MEX function.

Construction

`const_type=coder.Constant(v)` creates a `coder.Constant` type from the value `v`.

`codegen -globals {'g', coder.Constant(v)}` creates a constant global variable `g` with the value `v`.

`const_type=coder.newtype('constant', v)` creates a `coder.Constant` type from the value `v`.

Input Arguments

`v`

Constant value used to construct the type.

Properties

`Value`

The actual value of the constant.

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Generate MEX code for a MATLAB function with a constant input

This example shows how to generate MEX code for a MATLAB function that has a constant input. It shows how to use the `ConstantInputs` configuration parameter to control whether the MEX function signature includes constant inputs and whether the constant input values must match the compile-time values.

Write a function `identity` that copies its input to its output.

```
function y = identity(u) %#codegen
y = u;
```

Create a code configuration object for MEX code generation.

```
cfg = coder.config('mex');
```

Generate a MEX function `identity_mex` with the constant input `42`.

```
codegen identity -config cfg -args {coder.Constant(42)}
```

Call `identity_mex`. You must provide the input `42`.

```
identity_mex(42)
```

```
ans =

    42
```

Configure `ConstantInputs` so that the MEX function does not check that the input value matches the compile-time value.

```
cfg.ConstantInputs = 'IgnoreValues';
```

Generate `identity_mex` with the new configuration.

```
codegen identity -config cfg -args {coder.Constant(42)}
```

Call `identity_mex` with a constant input value other than `42` .

```
identity_mex(50)
```

```
ans =

    42
```

The MEX function ignored the input value `50`.

Configure `ConstantInputs` so that the MEX function does not include the constant input.

```
cfg.ConstantInputs = 'Remove';
```

Generate `identity_mex` with the new configuration.

```
codegen identity -config cfg -args {coder.Constant(42)}
```

Call `identity_mex`. Do not provide the input value .

```
identity_mex()
```

```
ans =

    42
```

Generate C code for a function that has constant input

This example shows how to generate C code for a function specialized to the case where an input has a constant value.

Write a function `identity` that copies its input to its output.

```
function y = identity(u) %#codegen
y = u;
```

Create a code configuration object for C code generation.

```
cfg = coder.config('lib');
```

Generate C code for `identity` with the constant input `42` and generate a report.

```
codegen identity -config cfg -args {coder.Constant(42)} -report
```

In the report, on the **C code** tab, click `identity.c`.

The function signature for `identity` is

```
double identity(void)
```

Generate MEX code for a function that uses constant global data

This example shows how to specify a constant value for a global variable at compile time.

Write a function `myfunction` that returns the value of the global constant `g`.

```
function  y = myfunction() %#codegen
global g;

y = g;

end
```

Create a configuration object for MEX code generation.

```
cfg = coder.config('mex');
```

Define a cell array `globals` that declares that `g` is a constant global variable with value `5`.

```
globals = {'g', coder.Constant(5)};
```

Generate a MEX function for `myfunction` using the `-globals` option to specify the global data.

```
codegen -config cfg -globals globals myfunction
```

Run the generated MEX function.

```
myfunction_mex
```

```
ans =

     5
```

See Also

`codegen` | `coder.newtype` | coder.Type

More About

- “Specify Constant Inputs at the Command Line”
- “Control Constant Inputs in MEX Function Signatures”
- “Define Constant Global Data”

coder.EmbeddedCodeConfig class

Package: coder
Superclasses: coder.CodeConfig

`codegen` configuration object that specifies code generation parameters for code generation with an Embedded Coder license

Description

A `coder.EmbeddedCodeConfig` object contains the configuration parameters that the `codegen` function requires to generate standalone C/C++ libraries and executables for an embedded target. Use the `-config` option to pass this object to the `codegen` function.

Construction

`cfg = coder.config('lib')` creates a code generation configuration object for C/C++ static library generation. If the Embedded Coder product is installed, it creates a `coder.EmbeddedCodeConfig` object. Otherwise, it creates a `coder.CodeConfig` object.

`cfg = coder.config('dll')` creates a code generation configuration object for C/C++ dynamic library generation. If the Embedded Coder product is installed, it creates a `coder.EmbeddedCodeConfig` object. Otherwise, it creates a `coder.CodeConfig` object.

`cfg = coder.config('exe')` creates a code generation configuration object for C/C++ executable generation. If the Embedded Coder product is installed, it creates a `coder.EmbeddedCodeConfig` object. Otherwise, it creates a `coder.CodeConfig` object.

`cfg = coder.config(output_type, 'ecoder', false)` creates a `coder.CodeConfig` object for the specified output type even if the Embedded Coder product is installed.

`cfg = coder.config(output_type, 'ecoder', true)` creates a `coder.EmbeddedCodeConfig` object for the specified output type even if the

Embedded Coder product is not installed. However, you cannot generate code using a `coder.EmbeddedCodeConfig` object unless an Embedded Coder license is available.

Properties

`BuildConfiguration`

Specify build configuration. `'Faster Builds'`, `'Faster Runs'`, `'Debug'`, `'Specify'`.

Default: *`string`*, `'Faster Builds'`

`CastingMode`

Specify data type casting level for variables in the generated C/C++ code.

Value	Description

`'Nominal'`	Generate C/C++ code that uses default C compiler data type casting. For example:
	
	`short addone(short x)`
	`{`
	`  int i0;`
	`  i0 = x + 1;`
	`  if (i0 > 32767) {`
	`    i0 = 32767;`
	`  }`
	
	`  return (short)i0;`
	`}`

`'Standards'`	Generate C/C++ code that casts data types to conform to MISRA® standards. For example:
	
	`short addone(short x)`
	`{`
	`  int i0;`
	`  i0 = (int)x + (int)1;`
	`  if (i0 > (int)32767) {`
	`    i0 = (int)32767;`
	`  }`

Value	Description

	`  return (short)i0;`
	`}`

`'Explicit'`	Generate C/C++ code that casts data type values explicitly. For example:
	
	`short addone(short x)`
	`{`
	`  int i0;`
	`  i0 = (int)x + 1;`
	`  if (i0 > 32767) {`
	`    i0 = 32767;`
	`  }`
	
	`  return (short)i0;`
	`}`

Default: *`string`*, `'Nominal'`

`CodeExecutionProfiling`

Enable execution-time profiling during a software-in-the-loop (SIL) or processor-in-the-loop (PIL) execution.

Default: `false`

`CodeTemplate`

Specify a code generation template for file and function banners in the generated code. This parameter is a handle to a `coder.MATLABCodeTemplate` object constructed from a code generation template (CGT) file.

This parameter is empty by default. If you do not set this parameter to a `coder.MATLABCodeTemplate` object, the code generation software generates default banners.

`CodeReplacementLibrary`

Specify an application-specific math library for the generated code.

Value	Description
`'None'`	Does not use a code replacement library.

Value	Description
`'GNU C99 extensions'`	Generates calls to the GNU gcc math library, which provides C99 extensions as defined by compiler option `-std=gnu99`.
`'Intel IPP for x86-64 (Windows)'`	Generates calls to the Intel Performance Primitives (IPP) library for the x86-64 Windows platform.
`'Intel IPP/SSE with GNU99 extensions for x86-64 (Windows)'`	Generates calls to the GNU libraries for Intel Performance Primitives (IPP) and Streaming SIMD Extensions (SSE), with GNU C99 extensions, for the x86-64 Windows platform.
`'Intel IPP for x86/Pentium (Windows)'`	Generates calls to the Intel Performance Primitives (IPP) library for the x86/ Pentium Windows platform.
`'Intel IPP/SSE with GNU99 extensions for x86/Pentium (Windows)'`	Generates calls to the GNU libraries for Intel Performance Primitives (IPP) and Streaming SIMD Extensions (SSE), with GNU C99 extensions, for the x86/Pentium Windows platform.
`'Intel IPP for x86-64 (Linux)'`	Generates calls to the Intel Performance Primitives (IPP) library for the x86-64 Linux platform.
`'Intel IPP/SSE with GNU99 extensions for x86-64 (Linux)'`	Generates calls to the GNU libraries for Intel Performance Primitives (IPP) and Streaming SIMD Extensions (SSE), with GNU C99 extensions, for the x86-64 Linux platform.

Compatible libraries depend on these parameters:

- `TargetLang`
- `TargetLangStandard`
- `ProdHWDeviceType` in the hardware implementation configuration object.

Embedded Coder offers more libraries and the ability to create and use custom code replacement libraries.

MATLAB Coder generates the minimal set of `#include` statements for header files required by the selected code replacement library.

Before setting this parameter, verify that your compiler supports the library that you want to use. If you select a parameter value that your compiler does not support, compiler errors can occur.

Note: MATLAB Coder software does not support TLC callbacks.

Default: *`string`*, `'None'`

`CommentStyle`

Specify comment style in the generated C or C++ code.

Value	Description
`'Auto'`	For C, generate multiline comments. For C++, generate single-line comments.
`'Single-line'`	Generate single-line comments preceded by `//`.
`'Multi-line'`	Generate single or multiline comments delimited by `/*` and `*/`.

For C code generation, specify the single-line comment style only if your compiler supports it.

Dependency: `GenerateComments` enables this parameter.

Default: *`string`*, `'Auto'`

`ConvertIfToSwitch`

Select whether to convert `if-elseif-else` patterns to `switch-case` statements. This optimization works only for integer and enumerated type inputs.

Default: `false`

`ConstantFoldingTimeout`

Specify the maximum number of instructions that the constant folder executes before stopping. In some situations, code generation requires specific instructions to be constant. If code generation is failing, increase this value.

Default: *`integer`*, `10000`

`CustomHeaderCode`

Specify code to appear near the top of each C/C++ header file generated from your MATLAB algorithm code.

Default: *`string`*, `''`

`CustomInclude`

Specify a space-separated list of include folders to add to the include path when compiling the generated code.

If your list includes Windows path strings that contain spaces, enclose each instance in double quotes within the argument string, for example:

```
'C:\Project "C:\Custom Files"'
```

Default: *`string`*, `''`

`CustomInitializer`

Specify code to appear in the initialize function of the generated `.c` or `.cpp` file.

Default: *`string`*, `''`

`CustomLibrary`

Specify a space-separated list of static library files to link with the generated code.

Default: *`string`*, `''`

`CustomSource`

Specify a space-separated list of source files to compile and link with the generated code.

Default: *`string`*, `''`

`CustomSourceCode`

Specify code to appear near the top of the generated `.c` or `.cpp` file, outside of a function.

Default: *`string`*, `''`

`CustomSymbolStrEMXArray`

Customize generated identifiers for EMX Array types (Embeddable mxArray types). See "Settings" on page 3-59.

Default: *`string`*, `'emxArray_$M$N'`

`CustomSymbolStrEMXArrayFcn`

Customize generated identifiers for EMX Array (Embeddable mxArrays) utility functions. See "Settings" on page 3-59.

Default: *`string`*, `'emx$M$N'`

`CustomSymbolStrFcn`

Customize generated local function identifiers. See "Settings" on page 3-59.

Default: *`string`*, `'m_$M$N'`

`CustomSymbolStrField`

Customize generated field names in global type identifiers. See "Settings" on page 3-59.

Default: *`string`*, `'$M$N'`

`CustomSymbolStrGlobalVar`

Customize generated global variable identifiers. See "Settings" on page 3-59.

Default: *`string`*, `'$M$N'`

`CustomSymbolStrMacro`

Customize generated constant macro identifiers. See "Settings" on page 3-59.

Default: *`string`*, `'$M$N'`

`CustomSymbolStrTmpVar`

Customize generated local temporary variable identifiers. See "Settings" on page 3-59.

Default: *`string`*, `'$M$N'`

`CustomSymbolStrType`

Customize generated global type identifiers. See “Settings” on page 3-59.

Default: *`string`*, `'$M$N'`

`CustomTerminator`

Specify code to appear in the terminate function of the generated `.c` or `.cpp` file.

Default: *`string`*, `''`

`CustomToolchainOptions`

Specify custom settings for each tool in the selected toolchain, as a cell array.

Dependencies:

- `Toolchain` determines which tools and options appear in the cell.
- Setting `BuildConfiguration` to `Specify` enables the options specified by `CustomToolchainOptions`.

Start by getting the current options and values. For example:

```
rtwdemo_sil_topmodel;
set_param(gcs, 'BuildConfiguration', 'Specify')
opt = get_param(gcs, 'CustomToolchainOptions')
```

Then edit the values in `opt`.

These values derive from the toolchain definition file and the third-party compiler options. See “Custom Toolchain Registration”.

Default: *`cell array`*

`DataTypeReplacement`

Specify whether to use built-in C data types or pre-defined types from `rtwtypes.h` in generated code.

Set to `'CoderTypeDefs'` to use the data types from `rtwtypes.h`. Otherwise, to use built-in C data types, retain default value or set to `'CBuiltIn'`.

Default: *`string`*, `'CBuiltIn'`

Description

Description of the `coder.EmbeddedCodeConfig` object.

Default: *`string`*, `'class EmbeddedCodeConfig: C code generation Ecoder configuration objects'`

DynamicMemoryAllocation

Control use of dynamic memory allocation for variable-size data.

By default, dynamic memory allocation is enabled for variable-size arrays whose size (in bytes) is greater than or equal to `DynamicMemoryAllocationThreshold`. `codegen` allocates memory for this variable-size data dynamically on the heap.

Set this property to `'Off'` to allocate memory statically on the stack. Set it to `'AllVariableSizeArrays'` to allocate memory for all variable-size arrays dynamically on the heap. You **must** use dynamic memory allocation for unbounded variable-size data.

Dependencies:

- `EnableVariableSizing` enables this parameter.
- Setting this parameter to `'Threshold'` enables the `DynamicMemoryAllocationThreshold` parameter.

Default: *`string`*, `'Threshold'`

DynamicMemoryAllocationThreshold

Specify the size threshold in bytes.`codegen` allocates memory on the heap for variable-size arrays whose size is greater than or equal to this threshold.

Dependency:

- Setting `DynamicMemoryAllocation` to `'Threshold'` enables this parameter.

Default: *`integer`*, `65536`

EnableAutoExtrinsicCalls

Specify whether MATLAB Coder must automatically treat common visualization functions as extrinsic functions. When this option is enabled, MATLAB Coder detects calls to many common visualization functions, such as `plot`, `disp`, and `figure`. For

MEX code generation, MATLAB Coder automatically calls out to MATLAB for these functions. For standalone code generation, MATLAB Coder does not generate code for these visualization functions. This capability reduces the amount of time that you spend making your code suitable for code generation. It also removes the requirement to declare these functions extrinsic using the `coder.extrinsic` function.

Default: `true`

`EnableMemcpy`

Optimize code generated for vector assignment by replacing for loops with `memcpy`.

Dependency:

- This parameter enables the associated parameter `MemcpyThreshold`.

Default: `true`

`EnableOpenMP`

If possible, enable OpenMP. Using the OpenMP library, the C/C++ code that MATLAB Coder generates for `parfor`-loops can run on multiple threads. With OpenMP disabled, MATLAB Coder treats `parfor`-loops as for-loops and generates C/C++ code that runs on a single thread.

Default: `true`

`EnableSignedLeftShifts`

Specify whether to replace multiplications by powers of two with signed left bitwise shifts in the generated C/C++ code. Some coding standards, such as MISRA, do not allow bitwise operations on signed integers. To increase the likelihood of generating MISRA C® compliant code, set this option to `false`.

When this option is `true`, MATLAB Coder uses signed left shifts for multiplication by powers of two. Here is an example of generated C code that uses signed left shift for multiplication by eight:

```
i <<= 3;
```

When this option is `false`, MATLAB Coder does not use signed left shifts for multiplication by powers of two. Here is an example of generated C code that does not use signed left shift for multiplication by eight:

```
i = i * 8;
```

Default: `true`

`EnableSignedRightShifts`

Specify whether to allow signed right bitwise shifts in the generated C/C++ code. Some coding standards, such as MISRA, do not allow bitwise operations on signed integers. To increase the likelihood of generating MISRA-C:2004 compliant code, set this option to `false`.

When this option is `true`, MATLAB Coder uses signed right shifts. Here is an example of generated C code that uses a signed right shift:

```
i >>= 3
```

When this option is `false`, MATLAB Coder replaces right shifts on signed integers with a function call in the generated code.

```
i = asr_s32(i, 3U);
```

Default: `true`

`EnableVariableSizing`

Enable support for variable-size arrays.

Dependency:

- This parameter enables the parameter `DynamicMemoryAllocation`.

Default: `true`

`FilePartitionMethod`

Specify whether to generate one C/C++ file for each MATLAB language file (`'MapMFileToCFile'`) or generate all C/C++ functions into a single file (`'SingleFile'`).

Default: *`string`*, `'MapMFileToCFile'`

`GenerateCodeMetricsReport`

Generate a static code metrics report including generated file information, number of lines, and memory usage.

Default: `false`

`GenCodeOnly`

Specify code generation versus an executable or library build.

Default: `false`

`GenerateCodeReplacementReport`

Generate a code replacements report that summarizes the replacements used from the selected code replacement library. The report provides a mapping between each code replacement instance and the line of MATLAB code that triggered the replacement.

Default: `false`

`GenerateComments`

Place comments in the generated files.

Dependencies:

- Enables `CommentStyle`.
- Enables `MATLABFcnDesc`.
- Enables `MATLABSourceComments`.

Default: `true`

`GenerateExampleMain`

Specify whether to generate an example C/C++ main function. If example main generation is enabled, MATLAB Coder generates source and header files for the main function in the `examples` subfolder of the build folder. For C code generation, it generates the files `main.c` and `main.h`. For C++ code generation, it generates the files `main.cpp` and `main.h`.

The example main function declares and initializes data. It calls entry-point functions but does not use values returned from the entry-point functions.

Before you use the example main files, copy them to another location and modify them to meet the requirements of your application.

Value	Description
`'DoNotGenerate'`	Does not generate an example C/C++ main function.
`'GenerateCodeOnly'`	Generates an example C/C++ main function but does not compile it.
`'GenerateCodeAndCompile'`	Generates an example C/C++ main function and compiles it to create a test executable. This executable does not return output. If the `GenCodeOnly` parameter is `true`, MATLAB Coder does not compile the C/C+ + main function.

Default: *`string`*, `'GenerateCodeOnly'`

`GenerateMakefile`

Specify whether to generate a makefile during the build process.

Default: `true`

`GenerateReport`

Default: `false`

`Hardware`

Handle to `coder.Hardware` object that specifies the hardware board for processor-in-the-loop (PIL) execution. Use `coder.hardware` to create the `coder.Hardware` object. For example:

```
cfg = coder.config('lib','ecoder',true);
hw = coder.hardware('BeagleBone Black');
cfg.Hardware = hw;
```

Dependencies:

- Setting `Hardware` sets `HardwareImplementation` to a `coder.HardwareImplementation` object customized for the hardware specified by `Hardware`.

`HardwareImplementation`

Handle to `coder.HardwareImplementation` object that specifies hardware-specific configuration parameters for C/C++ code generation.

If you set the `Hardware` property, `HardwareImplementation` is set to a `coder.HardwareImplementation` object customized for the hardware specified by `Hardware`. If you do not set the `Hardware` property, use `coder.HardwareImplementation` to create the `coder.HardwareImplementation` object. For example:

```
cfg = coder.config('lib');
hw_cfg = coder.HardwareImplementation;
cfg.HardwareImplementation = hw_cfg;
```

If `HardwareImplementation` is empty, the code generation software uses the settings for the MATLAB host computer.

Dependency:

Setting `Hardware` sets `HardwareImplementation` to a `coder.HardwareImplementation` object customized for the hardware specified by `Hardware`.

`HighlightPotentialDataTypeIssues`

Highlight potential data type issues in the code generation report. If this option is enabled, the code generation report highlights MATLAB code that results in single-precision or double-precision operations in the generated C/C++ code. If you have a Fixed-Point Designer™ license, the report also highlights expressions in the MATLAB code that result in expensive fixed-point operations in the generated code.

`IncludeTerminateFcn`

Generate a terminate function.

If you set this property to `false` but a terminate function is required, for example, to free memory, MATLAB Coder issues a warning.

Default: `true`

`IndentSize`

Specify the number of characters per indentation level. Specify an integer from 2 to 8.

Default: 2

`IndentStyle`

Specify the style for the placement of braces in the generated C/C++ code.

Value	Description

`'K&R'`	For blocks within a function, an opening brace is on the same line as its control statement. For example:
	
	`void addone(const double x[6], double z[6])`
	`{`
	`  int i0;`
	`  for (i0 = 0; i0 < 6; i0++) {`
	`    z[i0] = x[i0] + 1.0;`
	`  }`
	`}`

`'Allman'`	For blocks within a function, an opening brace is on its own line at the same indentation level as its control statement. For example:
	
	`void addone(const double x[6], double z[6])`
	`{`
	`  int i0;`
	`  for (i0 = 0; i0 < 6; i0++)`
	`  {`
	`    z[i0] = x[i0] + 1.0;`
	`  }`
	`}`

Default: `'K&R'`

`InitFltsAndDblsToZero`

Specify whether to generate code that explicitly initializes floating-point data to 0.0.

Default: `true`

`InlineStackLimit`

Specify the stack size limit on inlined functions. This specification determines the amount of stack space allocated for local variables of the inlined function.

Specifying a limit on the stack space constrains the amount of inlining allowed. For out-of-line functions, stack space for variables local to the function is released when the function returns. However, for inlined functions, stack space remains occupied by the local variables even when the function returns.

This feature is especially important for embedded processors, where stack size can be limited.

Default: *`integer`*, `4000`

`InlineThreshold`

Specify function size for inline threshold. Unless there are conflicts with other inlining conditions, MATLAB Coder inlines functions that are smaller than this size.

The function size is measured in terms of an abstract number of instructions, not actual MATLAB instructions or instructions in the target processor. You must experiment with this parameter to obtain the inlining behavior that you want. For instance, if the default setting for this parameter is leading to large functions being inlined, you can tune the parameter in steps until you are satisfied with the inlining behavior.

Default: *`integer`*, `10`

`InlineThresholdMax`

Specify the maximum size of functions after inlining. If the size of the calling function after inlining exceeds `InlineThresholdMax`, MATLAB Coder does not inline the called function.

The function size is measured in terms of an abstract number of instructions, not actual MATLAB instructions or instructions in the target processor. You must experiment with this parameter to obtain the inlining behavior that you want. For instance, if the default setting for this parameter is leading to the inlining of large functions, you can tune the parameter in steps until you are satisfied with the inlining behavior.

Default: *`integer`*, `200`

`LaunchReport`

Specify whether to display a report after code generation is complete or an error occurs.

Default: `true`

MATLABFcnDesc

Include MATLAB function help text in a function banner in generated code. If not selected, MATLAB Coder treats the help text as a user comment.

Dependencies:

- `GenerateComments` enables this parameter.

Default: `true`

MATLABSourceComments

Include MATLAB source code as comments in the generated code.

Dependencies:

- `GenerateComments` enables this parameter.

Default: `false`

MaxIdLength

Specify maximum number of characters in generated function, type definition, and variable names. To avoid truncation of identifiers by the target C compiler, specify a value that matches the maximum identifier length of the target C compiler.

This parameter does not apply to exported identifiers, such as the generated names for entry-point functions or emxArray API functions. If the length of an exported identifier exceeds the maximum identifier length of the target C compiler, the target C compiler truncates the exported identifier.

Minimum is 31. Maximum is 256.

Default: *`integer`*, `31`

MemcpyThreshold

Specify the minimum array size in bytes for which `memcpy` function calls must replace for loops in the generated code for nonscalar assignments.

Dependency:

- `EnableMemcpy` enables this parameter.

Default: *`integer`*, `64`

`MultiInstanceCode`

Generate reusable, multi-instance code that is reentrant.

Default: `false`

`Name`

Name of the configuration object.

Default: *`string`*, `'EmbeddedCodeConfig'`

`OutputType`

Specify whether to generate a standalone C/C++ static library, dynamic library, or executable. Set to `'LIB'` to generate a static library, `'DLL'` to generate a dynamic library or `'EXE'` to generate an executable.

Default: *`string`*, `'LIB'`

`ParenthesesLevel`

Specify the parenthesization level in the generated C/C++ code.

Value	Description
`'Minimum'`	Inserts parentheses where required by ANSI® C or C++, or to override default precedence. For example: `Out = In2 - In1 > 1.0 && In2 > 2.0;` If you generate C/C++ code using the minimum level, for certain settings in some compilers, you can receive compiler warnings. To eliminate these warnings, try the nominal level.

Value	Description
`'Nominal'`	Inserts parentheses to balance readability and visual complexity. For example: `Out = ((In2 - In1 > 1.0) && (In2 > 2.0));`
`'Maximum'`	Includes parentheses to specify meaning without relying on operator precedence. Code generated with this setting conforms to MISRA requirements. For example: `Out = (((In2 - In1) > 1.0) && (In2 > 2.0));`

Default: `*string*`, `'Nominal'`

`PassStructByReference`

Specify whether to pass structures by reference to entry-point functions. Set to `true` to pass structures by reference. You thereby reduce memory usage and execution time by minimizing the number of copies of parameters at entry-point function boundaries. Set to `false` to pass structures by value.

This parameter applies only to entry-point functions.

If you set this parameter to `true`, an entry-point function that writes to a field of a structure parameter overwrites the input value.

Default: `true`

`PostCodeGenCommand`

Specify command to customize build processing after code generation using `codegen`.

Default: *`string`*, `''`

`PreserveExternInFcnDecls`

Specify whether the declarations of external functions generated by `codegen` include the `extern` keyword.

Default: `true`

`PreserveVariableNames`

Specify the variable names that the variable reuse optimization must preserve.

Value	Description
`'UserNames'`	Preserve names that correspond to user-defined variables in the MATLAB code. For this option, the variable reuse optimization does not replace your variable name with another name and does not use your name for another variable. Use this option for readability. You can more easily trace the variables in the generated code back to the variables in your MATLAB code. The variable reuse optimization preserves your variable names, however, other optimizations can remove them from the generated code. MATLAB Coder does not reuse your variables in the generated C/C++ code, however, the C/C++ compiler can reuse these variables in the generated binary code.
`'None'`	The variable reuse optimization does not have to preserve any variable names. It can reuse any variables that meet the requirements for variable reuse. If your code uses large data structures or arrays, in some cases, the extra memory required to preserve your variable names can affect performance. In these cases, use this option to reduce memory usage or improve execution speed.
`'All'`	Preserve all variable names. This option disables variable reuse. Use this option only for testing or debugging. Do not use this option for production code.

Default: *`string`*, `'UserNames'`

`PurelyIntegerCode`

Specify whether to generate floating-point data and operations.

Default: `false`

`ReservedNameArray`

Enter a space-separated list of names that MATLAB Coder is not to use for naming functions or variables.

Default: *`string`*, `''`

`RuntimeChecks`

Enable run-time error detection and reporting in the generated C/C++ code. If you select this option, the generated code checks for errors such as out-of-bounds array indexing.

The error reporting software uses `fprintf` to write error messages to `stderr`. It uses `abort` to terminate the application. If `fprintf` and `abort` are not available, you must provide them. The `abort` function abruptly terminates the program. If your system supports signals, you can catch the abort signal (`SIGABRT`) so that you can control the program termination.

Error messages are in English.

Default: `false`

`SaturateOnIntegerOverflow`

Overflows saturate to either the minimum or maximum value that the data type can represent. Otherwise, the overflow behavior depends on your target C compiler. Most C compilers wrap on overflow.

This parameter applies only to MATLAB built-in integer types. It does not apply to doubles, singles, or fixed-point data types.

Default: `true`

`SILDebugging`

Enable debugger to observe code behavior during a software-in-the-loop (SIL) execution.

The software supports the following debuggers:

- On Windows, Microsoft Visual C++® debugger.
- On Linux, GNU Data Display Debugger (DDD).

Default: `false`

`StackUsageMax`

Specify the maximum stack usage per application in bytes. Set a limit that is lower than the available stack size. Otherwise, a run-time stack overflow can occur. The C compiler detects and reports overflows.

Default: *`integer`*, `200000`

`SupportNonFinite`

Specify whether to generate nonfinite data and operations.

Default: `true`

`TargetLang`

Specify the target language. Set to `'C'` to generate C code. Set to `C++` to generate C++ code. If you specify C++, MATLAB Coder wraps the C code into .cpp files so that you can use a C++ compiler and interface with external C++ applications. It does not generate C+ + classes.

Default: *`string`*, `'C'`

`TargetLangStandard`

Specify a standard math library for the generated code. Options depend on the language selection. For C, `'C89/C90 (ANSI)'` or `'C99 (ISO)'`. For C++, `'C89/C90 (ANSI)'`, `'C99 (ISO)'`, or `'C++03 (ISO)'`.

Before setting this parameter, verify that your compiler supports the library that you want to use. If you select a parameter value that your compiler does not support, compiler errors can occur.

Default: *`string`*, `'C89/C90 (ANSI)'`

`Toolchain`

Specify the toolchain to use. If you do not specify a toolchain, MATLAB Coder automatically locates an installed toolchain.

Default: *`string`*, `'Automatically locate an installed toolchain'`

`Verbose`

Display code generation progress.

Default: `false`

`VerificationMode`

Specify code verification mode.

- `'None'` — Normal execution
- `'SIL'` — Software-in-the-loop (SIL) execution
- `'PIL'` — Processor-in-the-loop (PIL) execution

Default: *`string`*, `'None'`

Settings

Enter a macro string that specifies whether, and in what order, certain substrings appear in the generated identifier. The macro string can include valid C-identifier characters and a combination of the following format tokens:

Token	Description
`$M`	Insert name mangling string to avoid naming collisions. Required.
`$N`	Insert name of parameter (global variable, global type, local function, local temporary variable, or constant macro) for which identifier is generated. Improves readability of generated code.
`$R`	Insert root project name into identifier, replacing unsupported characters with the underscore (_) character.

Copy Semantics

Handle. To learn how handle classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Generate a standalone C/C++ static library from a MATLAB function that is suitable for code generation.

Note: To generate code for this example, you must have an Embedded Coder license.

---

1 Write a MATLAB function, `coderand`, that generates a random scalar value from the standard uniform distribution on the open interval (0,1).

```
function r = coderand() %#codegen
% The directive %#codegen declares that the function
% is intended for code generation
r = rand();
```

2 Create a code generation configuration object to generate a static library.

```
cfg = coder.config('lib')
```

This command creates a `coder.EmbeddedCodeConfig` object.

3 Set the `PurelyIntegerCode` parameter to `true` to enable generation of integer-only code.

```
cfg.PurelyIntegerCode = true;
```

4 Generate the C library files in the default folder (codegen/lib/coderand). Use the `-config` option to specify the configuration object.

```
codegen -config cfg coderand
```

Alternatives

Use the `coder` function to create a MATLAB Coder project. The project provides a user interface that facilitates adding MATLAB files, defining input parameters, and specifying build parameters.

See Also

`codegen` | `coder` | `coder.config`

coder.EnumType class

Package: coder
Superclasses: coder.ArrayType

Represent set of MATLAB enumerations

Description

Specifies the set of MATLAB enumerations that the generated code should accept. Use only with the `codegen -args` options. Do not pass as an input to a generated MEX function.

Construction

`enum_type = coder.typeof(enum_value)` creates a `coder.EnumType` object representing a set of enumeration values of class (`enum_value`).

`enum_type = coder.typeof(enum_value, sz, variable_dims)` returns a modified copy of `coder.typeof(enum_value)` with (upper bound) size specified by `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is unbounded and the dimension is variable size. When `sz` is [], the (upper bound) sizes of `v` do not change. If you do not specify `variable_dims`, the bounded dimensions of the type are fixed; the unbounded dimensions are variable size. When `variable_dims` is a scalar, it applies to bounded dimensions that are not `1` or `0` (which are fixed).

`enum_type = coder.newtype(enum_name,sz,variable_dims)` creates a `coder.EnumType` object that has variable size with (upper bound) sizes `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is unbounded and the dimension is variable size. If you do not specify `variable_dims`, the bounded dimensions of the type are fixed. When `variable_dims` is a scalar, it applies to bounded dimensions that are not `1` or `0` (which are fixed).

Input Arguments

`enum_value`

Enumeration value defined in a file on the MATLAB path.

`sz`

Size vector specifying each dimension of type object.

Default: [1 1] for `coder.newtype`

`variable_dims`

Logical vector that specifies whether each dimension is variable size (true) or fixed size (false).

Default: false(size(sz)) | sz==Inf for `coder.newtype`

`enum_name`

Name of a numeration defined in a file on the MATLAB path.

Properties

`ClassName`

Class of values in the set.

`SizeVector`

The upper-bound size of arrays in the set.

`VariableDims`

A vector specifying whether each dimension of the array is fixed or variable size. If a vector element is `true`, the corresponding dimension is variable size.

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Create a `coder.EnumType` object using a value from an existing MATLAB enumeration.

1 Define an enumeration `MyColors`. On the MATLAB path, create a file named 'MyColors' containing:

```
classdef MyColors < int32
    enumeration
        green(1),
        red(2),
    end
end
```

2 Create a `coder.EnumType` object from this enumeration.

```
t = coder.typeof(MyColors.red);
```

Create a `coder.EnumType` object using the name of an existing MATLAB enumeration.

1 Define an enumeration `MyColors`. On the MATLAB path, create a file named 'MyColors' containing:

```
classdef MyColors < int32
    enumeration
        green(1),
        red(2),
    end
end
```

2 Create a `coder.EnumType` object from this enumeration.

```
t = coder.newtype('MyColors');
```

See Also

coder.ArrayType | `coder.newtype` | coder.Type | `coder.typeof` | `coder.resize` | `codegen`

How To

- “Enumerated Data”

coder.ExternalDependency class

Package: coder

Interface to external code

Description

`coder.ExternalDependency` is an abstract class for encapsulating the interface between external code and MATLAB code intended for code generation. You define classes that derive from `coder.ExternalDependency` to encapsulate the interface to external libraries, object files, and C/C++ source code. This encapsulation allows you to separate the details of the interface from your MATLAB code. The derived class contains information about external file locations, build information, and the programming interface to external functions.

To define a class, `myclass`, make the following line the first line of your class definition file:

```
classdef myclass < coder.ExternalDependency
```

You must define all of the methods listed in "Methods" on page 3-65. These methods are static and are not compiled. When you write these methods, use `coder.BuildConfig` methods to access build information.

You also define methods that call the external code. These methods are compiled. For each external function that you want to call, write a method to define the programming interface to the function. In the method, use `coder.ceval` to call the external function. Suppose you define the following method for a class named `AdderAPI`:

```
function c = adder(a, b)
    coder.cinclude('adder.h');
    c = 0;
    c = coder.ceval('adder', a, b);
end
```

This method defines the interface to a function `adder` which has two inputs `a` and `b`. In your MATLAB code, call `adder` this way:

```
y = AdderAPI.adder(x1, x2);
```

Methods

Examples

Encapsulate the interface to an external C dynamic linked library

This example shows how to encapsulate the interface to an external C dynamic linked library using `coder.ExternalDependency`.

Write a function `adder` that returns the sum of its inputs.

```
function c = adder(a,b)
    %#codegen
    c = a + b;
end
```

Generate a library that contains `adder`.

```
codegen('adder','-args', {-2,5}, '-config:dll', '-report');
```

Write the class definition file `AdderAPI.m` to encapsulate the library interface.

```
%================================================================
% This class abstracts the API to an external Adder library.
% It implements static methods for updating the build information
% at compile time and build time.
%================================================================

classdef AdderAPI < coder.ExternalDependency
    %#codegen

    methods (Static)

        function bName = getDescriptiveName(~)
            bName = 'AdderAPI';
        end

        function tf = isSupportedContext(ctx)
            if  ctx.isMatlabHostTarget()
                tf = true;
            else
                error('adder library not available for this target');
            end
```

```
end

function updateBuildInfo(buildInfo, ctx)
    [~, linkLibExt, execLibExt, ~] = ctx.getStdLibInfo();

    % Header files
    hdrFilePath = fullfile(pwd, 'codegen', 'dll', 'adder');
    buildInfo.addIncludePaths(hdrFilePath);

    % Link files
    linkFiles = strcat('adder', linkLibExt);
    linkPath = hdrFilePath;
    linkPriority = '';
    linkPrecompiled = true;
    linkLinkOnly = true;
    group = '';
    buildInfo.addLinkObjects(linkFiles, linkPath, ...
        linkPriority, linkPrecompiled, linkLinkOnly, group);

    % Non-build files
    nbFiles = 'adder';
    nbFiles = strcat(nbFiles, execLibExt);
    buildInfo.addNonBuildFiles(nbFiles,'','');
end

%API for library function 'adder'
function c = adder(a, b)
    if coder.target('MATLAB')
        % running in MATLAB, use built-in addition
        c = a + b;
    else
        % running in generated code, call library function
        coder.cinclude('adder.h');

        % Because MATLAB Coder generated adder, use the
        % housekeeping functions before and after calling
        % adder with coder.ceval.
        % Call initialize function before calling adder for the
        % first time.

        coder.ceval('adder_initialize');
        c = 0;
        c = coder.ceval('adder', a, b);
```

```
                % Call the terminate function after
                % calling adder for the last time.

                coder.ceval('adder_terminate');
            end
        end
    end
end
```

Write a function `adder_main` that calls the external library function `adder`.

```
function y = adder_main(x1, x2)
    %#codegen
    y = AdderAPI.adder(x1, x2);
end
```

Generate a MEX function for `adder_main`. The MEX Function exercises the `coder.ExternalDependency` methods.

```
codegen('adder_main', '-args', {7,9}, '-report')
```

Copy the library to the current folder using the file extension for your platform.

For Windows, use:

```
copyfile(fullfile(pwd, 'codegen', 'dll', 'adder', 'adder.dll'));
```

For Linux, use:

```
copyfile(fullfile(pwd, 'codegen', 'dll', 'adder', 'adder.so'));
```

Run the MEX function and verify the result.

```
adder_main_mex(2,3)
```

See Also

coder.BuildConfig | `coder.ceval` | `coder.cinclude` | `coder.updateBuildInfo`

More About

- “Encapsulating the Interface to External Code”
- “Best Practices for Using coder.ExternalDependency”

- “Build Information Object”
- “Build Information Methods”

coder.FiType class

Package: coder
Superclasses: coder.ArrayType

Represent set of MATLAB fixed-point arrays

Description

Specifies the set of fixed-point array values that the generated code should accept. Use only with the `codegen -args` options. Do not pass as an input to the generated MEX function.

Construction

`t=coder.typeof(v)` creates a `coder.FiType` object representing a set of fixed-point values whose properties are based on the fixed-point input `v`.

`t=coder.typeof(v, sz, variable_dims)` returns a modified copy of `coder.typeof(v)` with (upper bound) size specified by `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is unbounded and the dimension is variable size. When `sz` is [], the (upper bound) sizes of `v` do not change. If you do not specify the `variable_dims` input parameter, the bounded dimensions of the type are fixed. When `variable_dims` is a scalar, it applies to the bounded dimensions that are not `1` or `0` (which are fixed).

`t=coder.newtype('embedded.fi', numerictype, sz, variable_dims)` creates a `coder.Type` object representing a set of fixed-point values with `numerictype` and (upper bound) sizes `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is unbounded and the dimension is variable size. When you do not specify `variable_dims`, the bounded dimensions of the type are fixed. When `variable_dims` is a scalar, it applies to the bounded dimensions that are not `1` or `0` (which are fixed).

`t=coder.newtype('embedded.fi', numerictype, sz, variable_dims, Name, Value)` creates a `coder.Type` object representing a set of fixed-point values with `numerictype` and additional options specified by one or more Name, Value pair arguments. `Name` can also be a property name and `Value` is the corresponding value. `Name` must appear inside single quotes (`''`). You can specify several name-value pair arguments in any order as `Name1,Value1,…,NameN,ValueN`.

Input Arguments

`v`

Fixed-point value used to create new `coder.FiType` object.

`sz`

Size vector specifying each dimension of type object.

Default: [1 1] for `coder.newtype`

`variable_dims`

Logical vector that specifies whether each dimension is variable size (true) or fixed size (false).

Default: false(size(sz)) | sz ==Inf for `coder.newtype`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside single quotes (`' '`). You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

`'complex'`

Set `complex` to `true` to create a `coder.Type` object that can represent complex values. The type must support complex data.

Default: false

`'fimath'`

Specify local `fimath`. If not, uses default `fimath`.

Properties

`ClassName`

Class of values in the set.

`Complex`

Indicates whether fixed-point arrays in the set are real (`false`) or complex (`true`).

`Fimath`

Local `fimath` that the fixed-point arrays in the set use.

`NumericType`

numerictype that the fixed-point arrays in the set use.

`SizeVector`

The upper-bound size of arrays in the set.

`VariableDims`

A vector specifying whether each dimension of the array is fixed or variable size. If a vector element is `true`, the corresponding dimension is variable size.

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Create a new fixed-point type `t`.

```
t = coder.typeof(fi(1));
% Returns
% coder.FiType
%   1x1 embedded.fi
%       DataTypeMode:Fixed-point: binary point scaling
%         Signedness:Signed
%         WordLength:16
%     FractionLength:14
```

Create a new fixed-point type for use in code generation. The fixed-point type uses the default `fimath`.

```
t = coder.newtype('embedded.fi',numerictype(1, 16, 15), [1 2])

t =
% Returns
% coder.FiType
%   1x2 embedded.fi
%          DataTypeMode: Fixed-point: binary point scaling
%          Signedness: Signed
%          WordLength: 16
%          FractionLength: 15
```

This new type uses the default `fimath`.

See Also

coder.ArrayType | `coder.resize` | coder.Type | `coder.typeof` | `coder.newtype` | `codegen`

coder.FixptConfig class

Package: coder

Floating-point to fixed-point conversion configuration object

Description

A `coder.FixptConfig` object contains the configuration parameters that the MATLAB Coder `codegen` function requires to convert floating-point MATLAB code to fixed-point MATLAB code during code generation. Use the `-float2fixed` option to pass this object to the `codegen` function.

Construction

`*fixptcfg* = coder.config('fixpt')` creates a `coder.FixptConfig` object for floating-point to fixed-point conversion.

Properties

`ComputeDerivedRanges`

Enable derived range analysis.

Values: `true|false` (default)

`ComputeSimulationRanges`

Enable collection and reporting of simulation range data. If you need to run a long simulation to cover the complete dynamic range of your design, consider disabling simulation range collection and running derived range analysis instead.

Values: `true` (default)`|false`

`DefaultFractionLength`

Default fixed-point fraction length.

Values: 4 (default) | positive integer

`DefaultSignedness`

Default signedness of variables in the generated code.

Values: `'Automatic'` (default) | `'Signed'` | `'Unsigned'`

`DefaultWordLength`

Default fixed-point word length.

Values: 14 (default) | positive integer

`DetectFixptOverflows`

Enable detection of overflows using scaled doubles.

Values: `true`| `false` (default)

`fimath`

`fimath` properties to use for conversion.

Values: `fimath('RoundingMethod', 'Floor', 'OverflowAction', 'Wrap', 'ProductMode', 'FullPrecision', 'SumMode', 'FullPrecision')` (default) | string

`FixPtFileNameSuffix`

Suffix for fixed-point file names.

Values: `'_fixpt'` | string

`LaunchNumericTypesReport`

View the numeric types report after the software has proposed fixed-point types.

Values: `true` (default) | `false`

`LogIOForComparisonPlotting`

Enable simulation data logging to plot the data differences introduced by fixed-point conversion.

Values: `true` (default) | `false`

`OptimizeWholeNumber`

Optimize the word lengths of variables whose simulation min/max logs indicate that they are always whole numbers.

Values: `true` (default) | `false`

`PlotFunction`

Name of function to use for comparison plots.

`LogIOForComparisonPlotting` must be set to true to enable comparison plotting. This option takes precedence over `PlotWithSimulationDataInspector`.

The plot function should accept three inputs:

- A structure that holds the name of the variable and the function that uses it.
- A cell array to hold the logged floating-point values for the variable.
- A cell array to hold the logged values for the variable after fixed-point conversion.

Values: `''` (default) | string

`PlotWithSimulationDataInspector`

Use Simulation Data Inspector for comparison plots.

`LogIOForComparisonPlotting` must be set to true to enable comparison plotting. The `PlotFunction` option takes precedence over `PlotWithSimulationDataInspector`.

Values: `true`| `false` (default)

`ProposeFractionLengthsForDefaultWordLength`

Propose fixed-point types based on `DefaultWordLength`.

Values: `true` (default) | `false`

`ProposeTargetContainerTypes`

By default (false), propose data types with the minimum word length needed to represent the value. When set to true, propose data type with the smallest word length that can represent the range and is suitable for C code generation (8,16,32, 64 …). For example, for a variable with range [0..7], propose a word length of 8 rather than 3.

Values: `true`| `false` (default)

`ProposeWordLengthsForDefaultFractionLength`

Propose fixed-point types based on `DefaultFractionLength`.

Values: `false` (default) | `true`

`ProposeTypesUsing`

Propose data types based on simulation range data, derived ranges, or both.

Values: `'BothSimulationAndDerivedRanges'` (default) | `'SimulationRanges'`|`'DerivedRanges'`

`SafetyMargin`

Safety margin percentage by which to increase the simulation range when proposing fixed-point types. The specified safety margin must be a real number greater than `-100`.

Values: 0 (default) | double

`StaticAnalysisQuickMode`

Perform faster static analysis.

Values: `true` | `false` (default)

`StaticAnalysisTimeoutMinutes`

Abort analysis if timeout is reached.

Values: `''` (default) | positive integer

`TestBenchName`

Test bench function name or names, specified as a string or cell array of strings. You must specify at least one test bench.

If you do not explicitly specify input parameter data types, the conversion uses the first test bench function to infer these data types.

Values: `''` (default) | string | cell array of strings

`TestNumerics`

Enable numerics testing.

Values: `true` | `false` (default)

Methods

Examples

Generate Fixed-Point C Code from Floating-Point MATLAB Code

Create a `coder.FixptConfig` object, `fixptcfg`, with default settings.

```
fixptcfg = coder.config('fixpt');
```

Set the test bench name. In this example, the test bench function name is `dti_test`.

```
fixptcfg.TestBenchName = 'dti_test';
```

Create a code generation configuration object to generate a standalone C static library.

```
cfg = coder.config('lib');
```

Convert a floating-point MATLAB function to fixed-point C code. In this example, the MATLAB function name is `dti`.

```
codegen -float2fixed fixptcfg -config cfg dti
```

Convert Floating-Point MATLAB Code to Fixed Point Based On Derived Ranges

Create a `coder.FixptConfig` object, `fixptcfg`, with default settings.

```
fixptcfg = coder.config('fixpt');
```

Set the name of the test bench to use to infer input data types. In this example, the test bench function name is `dti_test`. The conversion process uses the test bench to infer input data types.

```
fixptcfg.TestBenchName = 'dti_test';
```

Select to propose data types based on derived ranges.

```
fixptcfg.ProposeTypesUsing = 'DerivedRanges';
fixptcfg.ComputeDerivedRanges = true;
```

Add design ranges. In this example, the `dti` function has one scalar double input, `u_in`. Set the design minimum value for `u_in` to `-1` and the design maximum to `1`.

```
fixptcfg.addDesignRangeSpecification('dti', 'u_in', -1.0, 1.0);
```

Convert the floating-point MATLAB function, `dti`, to fixed-point MATLAB code.

```
codegen -float2fixed fixptcfg  dti
```

Enable Overflow Detection

When you select to detect potential overflows, `codegen` generates a scaled double version of the generated fixed-point MEX function. Scaled doubles store their data in double-precision floating-point, so they carry out arithmetic in full range. They also retain their fixed-point settings, so they are able to report when a computation goes out of the range of the fixed-point type.

This example requires MATLAB Coder and Fixed-Point Designer licenses.

Create a `coder.FixptConfig` object, `fixptcfg`, with default settings.

```
fixptcfg = coder.config('fixpt');
```

Set the test bench name. In this example, the test bench function name is `dti_test`.

```
fixptcfg.TestBenchName = 'dti_test';
```

Enable numerics testing with overflow detection.

```
fixptcfg.TestNumerics = true;
fixptcfg.DetectFixptOverflows = true;
```

Create a code generation configuration object to generate a standalone C static library.

```
cfg = coder.config('lib');
```

Convert a floating-point MATLAB function to fixed-point C code. In this example, the MATLAB function name is `dti`.

```
codegen -float2fixed fixptcfg -config cfg dti
```

- “C Code Generation at the Command Line”

Alternatives

You can convert floating-point MATLAB code to fixed-point code using the MATLAB Coder app. Open the app using one of these methods:

- On the **Apps** tab, in the **Code Generation** section, click **MATLAB Coder**.
- Use the `coder` command.

See “Convert MATLAB Code to Fixed-Point C Code”.

See Also

coder.codeConfig | `codegen` | `coder` | `coder.config`

coder.HardwareImplementation class

Package: coder

`codegen` configuration object that specifies hardware implementation parameters for code generation

Description

A `coder.HardwareImplementation` object contains hardware-specific configuration parameters. The `codegen` function uses these parameters to generate standalone C/C ++ libraries and executables for specific target hardware. To use this object, refer to it from the related coder.CodeConfig or coder.EmbeddedCodeConfig object that `codegen` is using.

Construction

`hw_cfg = coder.HardwareImplementation` creates a `coder.HardwareImplementation` object.

Properties

`Description`

Description of hardware implementation object.

`string`, **`'class HardwareImplementation: Hardware implementation specifications.'`** , Maximum Length: 78 characters

`Name`

Name of hardware implementation object.

`string`, **`'HardwareImplementation'`** , Maximum Length: 22 characters

`ProdBitPerChar`

Describe length in bits of the C `char` data type that the deployment hardware supports.

Value must be a multiple of 8 between 8 and 32.

Dependencies:

- Specifying a device using the `ProdHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`integer`, **`8`**

`ProdBitPerDouble`

Describe the bit length of C `double` data type that the deployment hardware supports (read only).

`double`, **`64`**

`ProdBitPerFloat`

Describe the bit length of C floating-point data type that the deployment hardware supports (read only).

`double`, **`32`**

`ProdBitPerInt`

Describe length in bits of the C `int` data type that the deployment hardware supports.

Value must be a multiple of 8 between 8 and 32.

Dependencies:

- Specifying a device using the `ProdHWDeviceType` parameter sets a device-specific value for this parameter.

- This parameter is enabled only if you can modify it for the specified device.

integer, **32**

ProdBitPerLong

Describe length in bits of the C `long` data type that the deployment hardware supports.

Value must be a multiple of 8 between 32 and 128.

Dependencies:

- Specifying a device using the `ProdHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

integer, **32**

ProdBitPerLongLong

Describe length in bits of the C `long long` data type that the deployment hardware supports.

Tips:

- Use the C `long long` data type only if your C compiler supports `long long`.
- You can change the value of this parameter only for custom targets. For custom targets, values must be a multiple of 8 and between 64 and 128.

Dependencies:

- `ProdLongLongMode` enables use of this parameter.
- The value of this parameter must be greater than or equal to the value of `ProdBitPerLong`.
- Selecting a device using the `ProdHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

integer, **64**

ProdBitPerPointer

Describe the bit-length of pointer data for the deployment hardware (read only).

integer, **64**

ProdBitPerShort

Describe length in bits of the C `short` data type that the deployment hardware supports.

Value must be a multiple of 8 between 8 and 32.

Dependencies:

- Selecting a device using the `ProdHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

integer, **16**

ProdEndianess

Describe significance of the first byte of a data word for the deployment hardware.

string, `'Unspecified'`, **`'LittleEndian'`**, `'BigEndian'`

ProdEqTarget

Specify whether the test hardware differs from the deployment hardware.

Dependencies:

- Setting this parameter to `true` disables the target properties.
- Setting this parameter to `false` enables the target properties that specify the test hardware properties.

`true`, `false`

ProdHWDeviceType: [1x29 char]

Specify manufacturer and type of hardware that you use to implement the production version of the system.

Because `codegen` cannot generate code for ASICs or FPGAs, if `ProdHWDeviceType` is set to `ASIC/FPGA`, `TestHWDeviceType` is automatically set to `'Generic->MATLAB Host Computer'`.

`string`, **`'Generic->MATLAB Host Computer'`**

`ProdIntDivRoundTo`

Describe how your compiler rounds the result of dividing one signed integer by another to produce a signed integer quotient.

`string`, `'Undefined'`, **`'Zero'`**, `'Floor'`

`ProdLargestAtomicFloat`

Specify the largest floating-point data type that can be atomically loaded and stored on the deployment hardware.

Dependencies:

- Specifying a device using the `ProdHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`string`, **`'None'`**

`ProdLargestAtomicInteger`

Specify the largest integer data type that can be atomically loaded and stored on the deployment hardware.

Dependencies:

- Specifying a device using the `ProdHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.
- You can set this parameter to `long long` only if the deployment hardware supports the C `long long` data type and you have set the `ProdLongLongMode` parameter to `true`.

`string`, **`'Char'`**

ProdLongLongMode

Specify that your C compiler supports the C `long long` data type. Most C99 compilers support `long long`. Set to `true` to enable use of the C `long long` data type for code generation for the deployment hardware. Set to `false` to disable the use of C `long long` data type for code generation for the deployment hardware.

Tips:

- This parameter is enabled only if the specified deployment hardware supports the C `long long` data type.
- If your compiler does not support C `long long`, do not select this parameter.

Dependency:

- This parameter enables use of `ProdBitPerLongLong`.

`true`, `false`

ProdShiftRightIntArith

Describe whether your compiler implements a signed integer right shift as an arithmetic right shift.

`true`, `false`

ProdWordSize

Describe microprocessor native word size for the deployment hardware.

Value must be a multiple of 8 between 8 and 64.

Dependencies:

- Selecting a device using the `ProdHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`integer`, **`64`**

TargetBitPerChar

Describe length in bits of the C `char` data type that the test hardware supports.

Value must be a multiple of 8 between 8 and 32.

Dependencies:

- Specifying a device using the `TargetHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`integer`, **`8`**

`TargetBitPerDouble`

Describe the bit length of C `double` data type that the test hardware supports (read only).

`integer`, **`64`**

`TargetBitPerFloat`

Describe the bit length of C floating-point data type that the test hardware supports (read only).

`integer`, **`32`**

`TargetBitPerInt`

Describe length in bits of the C `int` data type that the test hardware supports.

Value must be a multiple of 8 between 8 and 32.

Dependencies:

- Specifying a device using the `TargetHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`integer`, **`32`**

`TargetBitPerLong`

Describe length in bits of the C `long` data type that the test hardware supports.

Value must be a multiple of 8 between 32 and 128.

Dependencies:

- Specifying a device using the `TargetHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`integer`, **`32`**

`TargetBitPerLongLong`

Describe length in bits of the C `long long` data type that the test hardware supports.

Dependencies:

- `TargetLongLongMode` enables use of this parameter.
- The value of this parameter must be greater than or equal to the value of `TargetBitPerLong`.

Tips:

- Use the C `long long` data type only if your C compiler supports `long long`.
- Change the value of this parameter for custom targets only. For custom targets, values must be a multiple of 8 and between 64 and 128.

`integer`, **`64`**

`TargetBitPerPointer`

Describe the bit-length of pointer data for the test hardware (read only).

`integer`, **`64`**

`TargetBitPerShort`

Describe length in bits of the C `short` data type that the test hardware supports.

Value must be a multiple of 8 between 8 and 32 .

Dependencies:

- Selecting a device using the `TargetHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`integer`, **`16`**

`TargetEndianess`

Describe significance of the first byte of a data word for the test hardware.

`string`, `'Unspecified'`, **`'LittleEndian'`**, `'BigEndian'`

`TargetHWDeviceType: [1x29 char]`

Specify manufacturer and type of the hardware that you use to test the generated code.

Because `codegen` cannot generate code for ASICs or FPGAs, if `ProdHWDeviceType` is set to `ASIC/FPGA`, `TestHWDeviceType` is automatically set to `'Generic->MATLAB Host Computer'`.

`string`, **`'Generic->MATLAB Host Computer'`**

`TargetIntDivRoundTo`

Describe how your compiler rounds the result of two signed integers for the test hardware.

`string`, `'Undefined'`, **`'Zero'`**, `'Floor'`

`TargetLargestAtomicFloat`

Specify the largest floating-point data type that can be atomically loaded and stored on the test hardware.

Dependencies:

- Specifying a device using the `TargetHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`string`, , **`'None'`**

`TargetLargestAtomicInteger`

Specify the largest integer data type that can be atomically loaded and stored on the test hardware.

Dependencies:

- Specifying a device using the `TargetHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.
- You can set this parameter to `long long` only if the test hardware supports the C `long long` data type and you have set the `TargetLongLongMode` parameter to `true`.

`string`, , **`'Char'`**

`TargetLongLongMode`

Specify that your C compiler supports the C `long long` data type. Most C99 compilers support `long long`. Set to `true` to enable use of the C `long long` data type for code generation for the test hardware. Set to `false` to disable use of the C `long long` data type for code generation for the test hardware.

Tips:

- This parameter is enabled only if the specified test hardware supports the C `long long` data type.
- If your compiler does not support C `long long`, do not select this parameter.

Dependency:

This parameter enables use of `TargetBitPerLongLong`.

`true`, `false`

`TargetShiftRightIntArith`

Describe whether your compiler implements a signed integer right shift as an arithmetic right shift.

`true`, `false`

`TargetWordSize`

Describe microprocessor native word size for the test hardware.

Value must be a multiple of 8 between 8 and 64.

Dependencies:

- Selecting a device using the`TargetHWDeviceType` parameter sets a device-specific value for this parameter.
- This parameter is enabled only if you can modify it for the specified device.

`integer`, **`64`**

Copy Semantics

Handle. To learn how handle classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Create a hardware implementation configuration object. Use the object to generate a C static library.

1. Create a hardware implementation configuration object.

   ```
   hw_cfg = coder.HardwareImplementation;
   ```
2. Create a code generation configuration object to generate a C static library.

   ```
   cfg = coder.config('lib');
   ```
3. Associate the hardware implementation object with the code generation configuration object.

   ```
   cfg.HardwareImplementation = hw_cfg;
   ```
4. Generate a C library for a MATLAB function `foo` that has no input parameters. Specify the configuration object using the `-config` option:

   ```
   codegen -config cfg foo
   ```

Alternatives

Use the `coder` function to create a MATLAB Coder project. The project provides a user interface that facilitates adding MATLAB files, defining input parameters, and specifying build parameters.

See Also

`codegen` | coder.CodeConfig | `coder` | coder.EmbeddedCodeConfig

coder.MexCodeConfig class

Package: coder

`codegen` configuration object that specifies MEX function generation parameters

Description

A `coder.MexCodeConfig` object contains the configuration parameters required by the `codegen` function to generate MEX functions. Use the `-config` option to pass the object to the `codegen` function.

Construction

`*cfg*=coder.config` creates a `coder.MexCodeConfig` object for MEX function generation.

`*cfg*=coder.config('mex')` creates a `coder.MexCodeConfig` object for MEX function generation.

Properties

`ConstantFoldingTimeout`

Specify, as a positive integer, the maximum number of instructions to be executed by the constant folder.

Default: *`integer`*, `10000`

`ConstantInputs`

Specify whether to include constant inputs in the MEX function signature.

By default, (`'CheckValues'`), the MEX function signature contains the constant inputs. The run-time values of the constant inputs must match their compile-time values. This option allows you to use the same test file to run the original MATLAB algorithm and the MEX function. Selecting this option slows down execution of the MEX function.

If you specify `'IgnoreValues'`, the MEX function signature contains the constant inputs. The run-time values of the constant inputs are ignored and do not need to match their compile-time values. This option allows you to use the same test file to run the original MATLAB algorithm and the MEX function.

If you specify `'Remove'`, the MEX function signature does not contain the constant inputs and does not match the MATLAB signature. This option is provided for backwards compatibility.

Default: *`string`*, `'CheckValues'`

`CustomHeaderCode`

Specify code to appear near the top of each C/C++ header file generated from your MATLAB algorithm code.

Default: *`string`*, `''`

`CustomInclude`

Specify a space-separated list of include folders to add to the include path when compiling the generated code.

If your list includes Windows path strings that contain spaces, enclose each instance in double quotes within the argument string, for example:

```
'C:\Project "C:\Custom Files"'
```

Default: *`string`*, `''`

`CustomInitializer`

Specify code to appear in the initialize function of the generated `.c` or `.cpp` file.

Default: *`string`*, `''`

`CustomLibrary`

Specify a space-separated list of static library files to link with the generated code.

Default: *`string`*, `''`

`CustomSource`

Specify a space-separated list of source files to compile and link with the generated code.

Default: *`string`*, `''`

`CustomSourceCode`

Specify code to appear near the top of the generated `.c` or `.cpp` file, outside of a function.

Default: *`string`*, `''`

`CustomTerminator`

Specify code to appear in the terminate function of the generated `.c` or `.cpp` file.

Default: *`string`*, `''`

`Description`

Description of object.

Default: *`string`*, `''`

`DynamicMemoryAllocation`

Control use of dynamic memory allocation for variable-size data.

By default, dynamic memory allocation is enabled for variable-size arrays whose size (in bytes) is greater than or equal to `DynamicMemoryAllocationThreshold` and `codegen` allocates memory for this variable-size data dynamically on the heap.

Set this property to `'Off'` to allocate memory statically on the stack. Set it to `'AllVariableSizeArrays'` to allocate memory for all arrays dynamically on the heap . You **must** use dynamic memory allocation for unbounded variable-size data.

Dependencies:

- `EnableVariableSizing` enables this parameter.
- Setting this parameter to `'Threshold'` enables the `DynamicMemoryAllocationThreshold` parameter.

Default: *`string`*, `'Threshold'`

`DynamicMemoryAllocationThreshold`

Specify the size threshold in bytes.`codegen` allocates memory on the heap for variable-size arrays whose size is greater than or equal to this threshold.

Dependency:

- Setting `DynamicMemoryAllocation` to `'Threshold'` enables this parameter.

Default: *`integer`*, `65536`

`EchoExpressions`

Specify whether or not actions that do not terminate with a semicolon appear in the MATLAB Command Window.

Default: `true`

`EnableAutoExtrinsicCalls`

Specify whether MATLAB Coder should automatically treat common visualization functions as extrinsic functions. When this option is enabled, MATLAB Coder detects calls to many common visualization functions, such as `plot`, `disp`, and `figure`. For MEX code generation, MATLAB Coder automatically calls out to MATLAB for these functions. For standalone code generation, MATLAB Coder does not generate code for these visualization functions. This capability reduces the amount of time that you spend making your code suitable for code generation. It also removes the requirement to declare these functions extrinsic using the `coder.extrinsic` function.

Default: `true`

`EnableDebugging`

Specify whether to use the debug option for the C compiler. If you enable debug mode, the C compiler does not optimize the code. The compilation is faster, but the execution is slower.

Default: `false`

`EnableMemcpy`

Optimize code generated for vector assignment by replacing for loops with `memcpy`.

Dependency:

- This parameter enables the associated parameter `MemcpyThreshold`.

Default: `true`

`EnableOpenMP`

If possible, enable OpenMP. Using the OpenMP library, the MEX functions that MATLAB Coder generates for `parfor`-loops can run on multiple threads. With OpenMP disabled, MATLAB Coder treats `parfor`-loops as for-loops and generates a MEX function that runs on a single thread.

Default: `true`

`EnableVariableSizing`

Enable support for variable-size arrays.

Dependency:

- Enables `Dynamic memory allocation`.

Default: `true`

`ExtrinsicCalls`

Allow calls to extrinsic functions.

An extrinsic function is a function on the MATLAB path that MATLAB Coder dispatches to MATLAB software for execution. MATLAB Coder does not compile or generate code for extrinsic functions.

When enabled (`true`), generates code for the call to a MATLAB function, but does not generate the function's internal code.

When disabled (`false`), ignores the extrinsic function. Does not generate code for the call to the MATLAB function — as long as the extrinsic function does not affect the output of the MATLAB function. Otherwise, issues a compilation error.

`ExtrinsicCalls` affects how MEX functions built by MATLAB Coder generate random numbers when using the MATLAB `rand`, `randi`, and `randn` functions. If extrinsic calls are enabled, the generated MEX function uses the MATLAB global random number stream to generate random numbers. If extrinsic calls are not enabled, the MEX function built with MATLAB Coder uses a self-contained random number generator.

If you disable extrinsic calls, the generated MEX function cannot display run-time messages from `error` or `assert` statements in your MATLAB code. The MEX function reports that it cannot display the error message. To see the error message, enable extrinsic function calls and generate the MEX function again.

Default: `true`

`FilePartitionMethod`

Specify whether to generate one C/C++ file for each MATLAB language file (`'MapMFileToCFile'`) or generate all C/C++ functions into a single file (`'SingleFile'`).

Default: *`string`*, `'MapMFileToCFile'`

`GenCodeOnly`

Control whether to compile the generated MEX function C/C++ code to produce a MEX function.

Default: `false`

`GenerateComments`

Place comments in the generated files.

Default: `true`

`GenerateReport`

Document generated code in a report.

Default: `false`

`GlobalDataSyncMethod`

Controls synchronization of MEX function global data with the MATLAB global workspace. For constant global data, controls verification of consistency between the MEX function constant global data and the MATLAB global workspace.

Value	Description for Global Data	Description for Constant Global Data
`SyncAlways` (default)	Synchronizes global data at MEX function entry and exit and for extrinsic calls for maximum consistency between MATLAB and the generated MEX function. To maximize performance, if the extrinsic calls do not change global data, use this option in conjunction with the `coder.extrinsic -sync:off` option to turn off synchronization for these calls.	Verifies consistency of constant global data at MEX function entry and after extrinsic calls. The MEX function ends with an error if the global data values in the MATLAB global workspace are inconsistent with the compile-time constant global values in the MEX function. Use the `coder.extrinsic -sync:off` option to turn off consistency checks after specific extrinsic calls.
`SyncAtEntryAndExits`	Synchronizes global data at MEX function entry and exit only. To maximize performance, if only a few extrinsic calls change global data, use this option in conjunction with the `coder.extrinsic -sync:on` option to turn on synchronization for these calls.	Verifies constant global data at MEX function entry only. The MEX function ends with an error if the global data values in the MATLAB global workspace are inconsistent with the compile-time constant global values in the MEX function. Use the `coder.extrinsic -sync:on` option to turn on consistency checks after specific extrinsic calls.
`NoSync`	Disables synchronization. Before disabling synchronization, verify that your MEX function does not interact with MATLAB globals. Otherwise, inconsistencies between MATLAB and the MEX function can occur.	Disables consistency checks.

Default: `SyncAlways`

`InitFltsAndDblsToZero`

Specify whether to generate code that explicitly initializes floating-point data to 0.0.

Default: `true`

`InlineStackLimit`

Specify the stack size limit on inlined functions. This specification determines the amount of stack space allocated for local variables of the inlined function.

Specifying a limit on the stack space constrains the amount of inlining allowed. For out-of-line functions, stack space for variables local to the function is released when the function returns. However, for inlined functions, stack space remains occupied by the local variables even when the function returns.

This feature is especially important for embedded processors, where stack size can be limited.

Default: *`integer`*, `4000`

`InlineThreshold`

Specify function size for inline threshold. Unless there are conflicts with other inlining conditions, MATLAB Coder inlines functions that are smaller than this size.

The function size is measured in terms of an abstract number of instructions, not actual MATLAB instructions or instructions in the target processor. You must experiment with this parameter to obtain the inlining behavior that you want. For instance, if the default setting for this parameter is leading to large functions being inlined and in turn generating large C code, you can tune the parameter in steps until you are satisfied with the size of generated code.

Default: *`integer`*, `10`

`InlineThresholdMax`

Specify the maximum size of functions after inlining. If the size of the calling function after inlining exceeds `InlineThresholdMax`, MATLAB Coder does not inline the called function.

The function size is measured in terms of an abstract number of instructions, not actual MATLAB instructions or instructions in the target processor. You must experiment with this parameter to obtain the inlining behavior that you want. For instance, if the default setting for this parameter is leading to large functions being inlined and in turn generating large C code, you can tune the parameter in steps until you are satisfied with the size of generated code.

Default: *`integer`*, `200`

IntegrityChecks

Detect violations of memory integrity in code generated for MATLAB functions and stops execution with a diagnostic message.

Setting `IntegrityChecks` to `false` also disables the run-time stack.

Default: `true`

LaunchReport

Specify whether to automatically display HTML reports after code generation is complete or an error occurs.

Default: `true`

MATLABSourceComments

Include MATLAB source code as comments in the generated code.

Dependencies:

- `GenerateComments` enables this parameter.

Default: `false`

MemcpyThreshold

Specify the minimum array size in bytes for which `memcpy` function calls should replace for loops in the generated code for vector assignments.

Dependency:

- `EnableMemcpy` enables this parameter.

Default: *`integer`*, `64`

Name

Name of code generation configuration object.

Default: *`string`*, `'MexCodeConfig'`

`PostCodeGenCommand`

Specify command to customize build processing after MEX function generation using `codegen`.

Default: *`string`*, `''`

`PreserveVariableNames`

Specify the variable names that the variable reuse optimization must preserve.

Value	Description
`UserNames`	Preserve names that correspond to user-defined variables in the MATLAB code. For this option, the variable reuse optimization does not replace your variable name with another name and does not use your name for another variable. Use this option for readability. You can more easily trace the variables in the generated code back to the variables in your MATLAB code. The variable reuse optimization preserves your variable names, however, other optimizations can remove them from the generated code. MATLAB Coder does not reuse your variables in the generated C/C++ code, however, the C/C++ compiler can reuse these variables in the generated binary code.
`None`	The variable reuse optimization does not have to preserve any variable names. It can reuse any variables that meet the requirements for variable reuse. If your code uses large data structures or arrays, in some cases, the extra memory required to preserve your variable names can affect performance. In these cases, use this option to reduce memory usage or improve execution speed.

Value	Description
`All`	Preserve all variable names. This option disables variable reuse. Use this option only for testing or debugging. Do not use this option for production code.

Default: *`string`*, `'UserNames'`

`ReservedNameArray`

Enter a list of names that MATLAB Coder is not to use for naming functions or variables.

Default: *`string`*, `''`

`ResponsivenessChecks`

Enable responsiveness checks in code generated for MATLAB functions.

These checks enable periodic checks for Ctrl+C breaks in the generated code. Enabling responsiveness checks also enables graphics refreshing.

Caution These checks are enabled by default for safety. Without these checks, the only way to end a long-running execution might be to terminate MATLAB.

Default: `true`

`SaturateOnIntegerOverflow`

Overflows saturate to either the minimum or maximum value that the data type can represent. Otherwise, the overflow behavior depends on your target C compiler. Most C compilers wrap on overflow.

This parameter applies only to MATLAB built-in integer types. It does not apply to doubles, singles, or fixed-point data types.

Default: `true`

`StackUsageMax`

Specify the maximum stack usage per application in bytes. Set a limit that is lower than the available stack size. Otherwise, a runtime stack overflow might occur. Overflows are detected and reported by the C compiler, not by `codegen`.

Default: *`integer`*, `200000`

`TargetLang`

Specify the target language. Set to `'C'` to generate C code. Set to `C++` to generate C++ code. If you specify C++, MATLAB Coder wraps the C code into .cpp files so that you can use a C++ compiler and interface with external C++ applications. It does not generate C++ classes.

Default: *`string`*, `'C'`

Copy Semantics

Handle. To learn how handle classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Generate a MEX function from a MATLAB function that is suitable for code generation and enable a code generation report.

1 Write a MATLAB function, `coderand`, that generates a random scalar value from the standard uniform distribution on the open interval (0,1).

   ```
   function r = coderand() %#codegen
   % The directive %#codegen declares that the function
   % is intended for code generation
   r = rand();
   ```

2 Create a code generation configuration object to generate a MEX function.

   ```
   cfg = coder.config('mex')
   ```

3 Enable the code generation report.

   ```
   cfg.GenerateReport = true;
   ```

4 Generate a MEX function in the current folder specifying the configuration object using the `-config` option.

   ```
   % Generate a MEX function and code generation report
   codegen -config cfg coderand
   ```

Alternatives

Use the `coder` function to create a MATLAB Coder project. The project provides a user interface that facilitates adding MATLAB files, defining input parameters, and specifying build parameters.

See Also

`codegen` | `coder` | | `coder.extrinsic`

coder.PrimitiveType class

Package: coder
Superclasses: coder.ArrayType

Represent set of logical, numeric, or char arrays

Description

Specifies the set of logical, numeric, or char values that the generated code should accept. Supported classes are `double`,`single`,`int8`,`uint8`,`int16`,`uint16`,`int32`,`uint32`,`int64`,`uint64`, `char`, and `logical`. Use only with the `codegen -args` option. Do not pass as an input to a generated MEX function.

Construction

`t=coder.typeof(v)` creates a `coder.PrimitiveType` object denoting the smallest non-constant type that contains `v`. `v` must be a MATLAB numeric, logical or char.

`t=coder.typeof(v, sz, variable_dims)` returns a modified copy of `coder.typeof(v)` with (upper bound) size specified by `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is assumed to be unbounded and the dimension is assumed to be variable sized. When `sz` is [], the (upper bound) sizes of `v` remain unchanged. When `variable_dims` is not specified, the dimensions of the type are assumed to be fixed except for those that are unbounded. When `variable_dims` is a scalar, it is applied to bounded dimensions that are not `1` or `0` (which are assumed to be fixed).

`t=coder.newtype(numeric_class, sz, variable_dims)` creates a `coder.PrimitiveType` object representing values of class `numeric_class` with (upper bound) sizes `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is assumed to be unbounded and the dimension is assumed to be variable sized. When `variable_dims` is not specified, the dimensions of the type are assumed to be fixed except for those that are unbounded. When `variable_dims` is a scalar, it is applied to the dimensions of the type that are not `1` or `0` (which are assumed to be fixed).

`t=coder.newtype(numeric_class, sz, variable_dims, Name, Value)` creates a `coder.PrimitiveType` object with additional options specified by one or more Name, Value pair arguments. `Name` can also be a property name and `Value` is the corresponding value. `Name` must appear inside single quotes (`''`). You can specify several name-value pair arguments in any order as `Name1,Value1,…,NameN,ValueN`.

Input Arguments

`v`

Input that is not a `coder.Type` object

`sz`

Size for corresponding dimension of type object. Size must be a valid size vector.

Default: [1 1] for `coder.newtype`

`variable_dims`

Logical vector that specifies whether each dimension is variable size (true) or fixed size (false).

Default: false(size(sz)) | sz==Inf for `coder.newtype`

`numeric_class`

Class of type object.

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside single quotes (`' '`). You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

`'complex'`

Set `complex` to `true` to create a `coder.PrimitiveType` object that can represent complex values. The type must support complex data.

Default: false

`'sparse'`

Set `sparse` to `true` to create a `coder.PrimitiveType` object representing sparse data. The type must support sparse data.

Default: false

Properties

`ClassName`

Class of values in this set

`Complex`

Indicates whether the values in this set are real (`false`) or complex (`true`)

`SizeVector`

The upper-bound size of arrays in this set.

`Sparse`

Indicates whether the values in this set are sparse arrays (`true`)

`VariableDims`

A vector used to specify whether each dimension of the array is fixed or variable size. If a vector element is `true`, the corresponding dimension is variable size.

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Create a `coder.PrimitiveType` object.

```
z = coder.typeof(0,[2 3 4],[1 1 0]) % returns double :2x:3x4
% ':' indicates variable-size dimensions
```

Create a `coder.PrimitiveType` object then call `codegen` to generate a C library for a function `fcn.m` that has one input parameter of this type.

1. Create a `coder.PrimitiveType` object.

   ```
   z = coder.typeof(0,[2 3 4],[1 1 0]) % returns double :2x:3x4
   % ':' indicates variable-size dimensions
   ```
2. Call `codegen` to generate a C library for a MATLAB function `fcn.m` that has one input parameter type `z`.

   ```
   % Use the config:lib option to generate a C library
   codegen -config:lib fcn -args {z}
   ```

See Also

coder.ArrayType | `coder.typeof` | coder.Type | `coder.newtype` | `coder.resize` | `codegen`

coder.StructType class

Package: coder
Superclasses: coder.ArrayType

Represent set of MATLAB structure arrays

Description

Specifies the set of structure arrays that the generated code should accept. Use only with the `codegen -args` option. Do not pass as an input to a generated MEX function.

Construction

`t=coder.typeof(struct_v)` creates a `coder.StructType` object for a structure with the same fields as the scalar structure `struct_v`.

`t=coder.typeof(struct_v, sz, variable_dims)` returns a modified copy of `coder.typeof(struct_v)` with (upper bound) size specified by `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is assumed to be unbounded and the dimension is assumed to be variable sized. When `sz` is [], the (upper bound) sizes of `struct_v` remain unchanged. If the `variable_dims` input parameter is not specified, the dimensions of the type are assumed to be fixed except for those that are unbounded. When `variable_dims` is a scalar, it is applied to the bounded dimensions that are not `1` or `0` (which are assumed to be fixed).

`t=coder.newtype('struct', struct_v, sz, variable_dims)` creates a `coder.StructType` object for an array of structures with the same fields as the scalar structure `struct_v` and (upper bound) size `sz` and variable dimensions `variable_dims`. If `sz` specifies `inf` for a dimension, then the size of the dimension is assumed to be unbounded and the dimension is assumed to be variable sized. When `variable_dims` is not specified, the dimensions of the type are assumed to be fixed except for those that are unbounded. When `variable_dims` is a scalar, it is applied to the dimensions of the type, except if the dimension is `1` or `0`, which is assumed to be fixed.

Input Arguments

`struct_v`

Scalar structure used to specify the fields in a new structure type.

`sz`

Size vector specifying each dimension of type object.

Default: [1 1] for `coder.newtype`

`variable_dims`

Logical vector that specifies whether each dimension is variable size (true) or fixed size (false).

Default: false(size(sz)) | sz==Inf for `coder.newtype`

Properties

`Alignment`

The run-time memory alignment of structures of this type in bytes. If you have an Embedded Coder license and use Code Replacement Libraries (CRLs), the CRLs provide the ability to align data objects passed into a replacement function to a specified boundary. This capability allows you to take advantage of target-specific function implementations that require data to be aligned. By default, the structure is not aligned on a specific boundary so it will not be matched by CRL functions that require alignment.

`Alignment` must be either `-1` or a power of `2` that is no more than `128`.

`ClassName`

Class of values in this set.

`Extern`

Whether the structure type is externally defined.

`Fields`

A structure giving the `coder.Type` of each field in the structure.

`HeaderFile`

If the structure type is externally defined, name of the header file that contains the external definition of the structure, for example, `"mystruct.h"`. Specify the path to the file using the `codegen -I` option or the **Additional include directories** parameter in the MATLAB Coder project settings dialog box **Custom Code** tab.

By default, the generated code contains `#include` statements for custom header files after the standard header files. If a standard header file refers to the custom structure type, then the compilation fails. By specifying the `HeaderFile` option, MATLAB Coder includes that header file exactly at the point where it is required.

Must be a non-empty string.

`SizeVector`

The upper-bound size of arrays in this set.

`VariableDims`

A vector used to specify whether each dimension of the array is fixed or variable size. If a vector element is `true`, the corresponding dimension is variable size.

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

Examples

Create a type for a structure with a variable-size field.

```
x.a = coder.typeof(0,[3 5],1);
x.b = magic(3);
coder.typeof(x)
% Returns
% coder.StructType
%    1x1 struct
%      a:  :3x:5 double
%      b:  3x3  double
% ':' indicates variable-size dimensions
```

Create a `coder.StructType` object then call `codegen` to generate a C library for a function `fcn.m` that has one input parameter of this type

1. Create a new structure type.

   ```
   ta = coder.newtype('int8',[1 1]);
   tb = coder.newtype('double',[1 2],[1 1]);
   z = coder.newtype('struct',struct('a',ta,'b',tb))
   % Returns
   % coder.StructType
   %   1x1 struct
   %      a: 1x1 int8
   %      b: :1x:2 double
   ```
2. Call `codegen` to generate a C library for a MATLAB function `fcn.m` that has one input parameter of this type.

   ```
   % Use the -config:lib option to generate a C library
   codegen -config:lib fcn -args {z}
   ```

Create a `coder.StructType` object that uses an externally-defined structure type.

1. Create a type that uses an externally-defined structure type.

   ```
   S.a = coder.typeof(double(0));
   S.b = coder.typeof(single(0));
   T = coder.typeof(S);
   T = coder.cstructname(T,'mytype','extern','HeaderFile','myheader.h');

   T =

   coder.StructType
      1x1 extern mytype (myheader.h) struct
         a: 1x1 double
         b: 1x1 single
   ```
2. View the types of the structure fields.

   ```
   T.Fields

   ans =

       a: [1x1 coder.PrimitiveType]
       b: [1x1 coder.PrimitiveType]
   ```

See Also

coder.EnumType | coder.FiType | coder.Constant | coder.ArrayType | `coder.typeof` | `coder` | `coder.cstructname` | coder.Type | coder.PrimitiveType | `coder.newtype` | `coder.resize` | `codegen`

coder.SingleConfig class

Package: coder

Double-precision to single-precision conversion configuration object

Description

A `coder.SingleConfig` object contains the configuration parameters that the MATLAB Coder `codegen` function requires to convert double-precision code to single-precision MATLAB code. To pass this object to the `codegen` function, use the `-double2single` option.

Construction

`scfg = coder.config('single')` creates a `coder.SingleConfig` object for double-precision to single-precision conversion.

Properties

`OutputFileNameSuffix` — Suffix for single-precision file name

`'_single'` (default) | string

Suffix that the single-conversion process uses for generated single-precision files.

`LogIOForComparisonPlotting` — Enable simulation data logging for comparison plotting of input and output variables

`false` (default) | true

Enable simulation data logging to plot the data differences introduced by single-precision conversion.

`PlotFunction` — Name of function for comparison plots

`''` (default) | string

Name of function to use for comparison plots.

To enable comparison plotting, set `LogIOForComparisonPlotting` to true. This option takes precedence over `PlotWithSimulationDataInspector`.

The plot function must accept three inputs:

- A structure that holds the name of the variable and the function that uses it.
- A cell array to hold the logged floating-point values for the variable.
- A cell array to hold the logged values for the variable after fixed-point conversion.

`PlotWithSimulationDataInspector` — Specify use of Simulation Data Inspector for comparison plots
`false` (default) | `true`

Use Simulation Data Inspector for comparison plots.

`LogIOForComparisonPlotting` must be set to true to enable comparison plotting. The `PlotFunction` option takes precedence over `PlotWithSimulationDataInspector`.

`TestBenchName` — Name of test file
`''` (default) | string | cell array of strings

Test file name or names, specified as a string or cell array of strings. Specify at least one test file.

If you do not explicitly specify input parameter data types, the conversion uses the first file to infer these data types.

`TestNumerics` — Enable numerics testing
`false` (default) | `true`

Enable numerics testing to verify the generated single-precision code. The test file runs the single-precision code.

Methods

Examples

Generate Single-Precision MATLAB Code

Create a `coder.SingleConfig` object.

```
scfg= coder.config('single');
```

Set the properties of the doubles-to-singles configuration object. Specify the test file. In this example, the name of the test file is `myfunction_test`. The conversion process uses the test file to infer input data types and collect simulation range data. Enable numerics testing and generation of comparison plots.

```
scfg.TestBenchName = 'myfunction_test';
scfg.TestNumerics = true;
scfg.LogIOForComparisonPlotting = true;
```

Run `codegen`. Use the `-double2single` option to specify the `coder.SingleConfig` that you want to use. In this example, the MATLAB function name is `myfunction`.

```
codegen -double2single scfg myfunction
```

- “Generate Single-Precision MATLAB Code”
- “Generate Single-Precision C Code at the Command Line”

Alternatives

You can convert double-precision MATLAB code to single-precision C/C++ code by using the `'singleC'` option of the `codegen` function.

You can convert double-precision MATLAB code to single-precision code using the MATLAB Coder app. Open the app using one of these methods:

- On the **Apps** tab, in the **Code Generation** section, click **MATLAB Coder**.
- Use the `coder` command.

See Also

`codegen` | `coder.config`

Introduced in R2015b

coder.Type class

Package: coder

Represent set of MATLAB values

Description

Specifies the set of values that the generated code should accept. Use only with the `codegen -args` option. Do not pass as an input to a generated MEX function.

Construction

`coder.Type` is an abstract class, and you cannot create instances of it directly. You can create `coder.Constant`, `coder.EnumType`, `coder.FiType`, `coder.PrimitiveType`, `coder.StructType`, and `coder.CellType` objects that are derived from this class.

Properties

`ClassName`

Class of values in this set

Copy Semantics

Value. To learn how value classes affect copy operations, see Copying Objects in the MATLAB documentation.

See Also

coder.EnumType | coder.FiType | coder.Constant | coder.ArrayType | `coder.typeof` | `coder` | coder.CellType | coder.StructType | coder.PrimitiveType | `coder.newtype` | `coder.resize` | `codegen`

coder.make.BuildConfiguration class

Package: coder.make

Represent build configuration

Description

A build configuration contains information on how to build source code and binaries.

Give each build configuration a unique name that you can use to reference or access it, such as ‘Faster Builds’.

A build configuration contains options with values. Each option maps to a build tool in the ToolchainInfo object that uses the build configuration.

For example, a build configuration can contain options for the following build tools in `coder.make.ToolchainInfo`:

- C Compiler
- C++ Compiler’
- Linker
- Shared Library Linker
- Archiver
- Download
- Execute

The value of each option can vary from one build configuration to another. For example, the “Faster Runs” build configuration can have compiler options that include optimization flags, while the “Debug” build configuration can have compiler options that include a symbolic debug flag.

Construction

```
ConfigObj = coder.make.BuildConfiguration(ConfigName,{Name,
Value,...})
```

Input Arguments

`ConfigName` — Name of build configuration
string

Name of build configuration, specified as a string.

Example: `'Faster Builds II'`

Data Types: `char`

Name-Value Pair Arguments

Specify optional comma-separated pairs of `Name,Value` arguments. `Name` is the argument name and `Value` is the corresponding value. `Name` must appear inside single quotes (`' '`). You can specify several name and value pair arguments in any order as `Name1,Value1,...,NameN,ValueN`.

`'Name'` — Name of option
string

Name of option, specified as a string.

Data Types: `char`

`'Value'` — Value of option
string

Value of option, specified as a string.

Data Types: `char`

Output Arguments

`ConfigObj` — Object handle for configuration
variable

Object handle for configuration, returned as a variable.

Data Types: `char`

Properties

`Description` — Brief description of build configuration

A brief description of the build configuration. The MATLAB Coder software displays this description in the project build settings, on the **Hardware** tab, below the **Build Configuration** parameter.

You can assign a description to this property after you create the `BuildConfiguration` object.

```
config.Description = 'BldConfigDescription'
```

```
config =

#############################################
# Build Configuration : BldConfigName
# Description         : BldConfigDescription
#############################################
```

Data type: `char`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`Name` — Name of build configuration

The name of the build configuration.

You can assign a name to this property when you create a `BuildConfiguration` object.

```
config = coder.make.BuildConfiguration ...
('BldConfigName',{'optiona','1','optionb','2','optionc','3'})
```

You can also assign a name to this property after you create a `BuildConfiguration` object.

```
config.Name = 'BldConfigName'
```

Both approaches produce the same result

```
config =
##############################################
# Build Configuration : BldConfigName
# Description         :
##############################################
```

Data type: `char`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`Options` — List of options or settings for specific build configuration

A list of options or settings for a specific build configuration. This list contains name-value pairs. The `Options` property has an option for each `coder.make.BuildTool` object in `coder.make.Toolchain.BuildTools`. For example, `Options` has a `C Compiler` option for the `C Compiler` build tool.

Data type: `coder.make.UnorderedList`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

Methods

Copy Semantics

Handle. To learn how handle classes affect copy operations, see Copying Objects in the MATLAB documentation.

See Also

`coder.make.BuildItem` | `coder.make.BuildTool` | `coder.make.ToolchainInfo` | `coder.make.ToolchainInfo.getBuildConfiguration` | `coder.make.ToolchainInfo.removeBuildConfiguration`

| `coder.make.ToolchainInfo.setBuildConfiguration` | `coder.make.ToolchainInfo.setBuildConfigurationOption`

Related Examples

- “Adding a Custom Toolchain”
- “Toolchain Definition File with Commentary”

coder.make.BuildItem class

Package: coder.make

Represent build item

Description

Create a `coder.make.BuildItem` object that can have macro name and value. Then, use the `BuildItem` object as an argument for one of the following `coder.make.BuildTool` methods:

- `coder.make.BuildTool.getCommand`
- `coder.make.BuildTool.setCommand`
- `coder.make.BuildTool.setPath`
- `coder.make.BuildTool.addFileExtension`

Note: What is a *macro*? The term has a different meaning depending on the context:

- In this context, a macro is a variable that the makefile can use to refer to a given value, such as a build tool's command, path, or file extension.
- In topics for the `coder.make.ToolchainInfo.Macros` and related methods, a macro is a variable that the makefile can use to refer to arbitrary or predefined value.

Construction

`h = coder.make.BuildItem(blditm_macrovalue)` creates a `coder.make.BuildItem` object that has a value.

`h = coder.make.BuildItem(blditm_macroname,blditm_value)` creates a `coder.make.BuildItem` object that has a macro name and value.

Input Arguments

`blditm_macroname` — Macro name of build item
string

Macro name of build item, specified as a string.

Data Types: `char`

`blditm_value` — Value of build item
string

Value of build item

Data Types: `char`

Output Arguments

`buildItemHandle` — BuildItem handle
object handle

BuildItem handle, specified as a `coder.make.BuildItem` object that contains an option value.

Example: `bi`

Methods

Copy Semantics

Handle. To learn how handle classes affect copy operations, see Copying Objects in the MATLAB documentation.

Example

```
bi1 = coder.make.BuildItem('BuildItemMacroValue')
```

```
bi1 =

 Macro  : (empty)
 Value : BuildItemMacroValue
```

```
bi2 = coder.make.BuildItem('BIMV','BuildItemMacroValue')
```

```
bi2 =

 Macro  : BIMV
 Value : BuildItemMacroValue
```

See Also

`coder.make.ToolchainInfo` | `coder.make.BuildTool` | `coder.make.ToolchainInfo` | `coder.make.BuildTool.getCommand` | `coder.make.BuildTool.setCommand` | `coder.make.BuildTool.setPath` | `coder.make.BuildTool.addFileExtension`

Related Examples

- “Adding a Custom Toolchain”

coder.make.BuildTool class

Package: coder.make

Represent build tool

Description

Use `coder.make.BuildTool` to get and define an existing default `coder.make.BuildTool` object, or to create a new `coder.make.BuildTool` object.

In most cases, get and define one of the default `BuildTool` objects from the following `ToolchainInfo` properties:

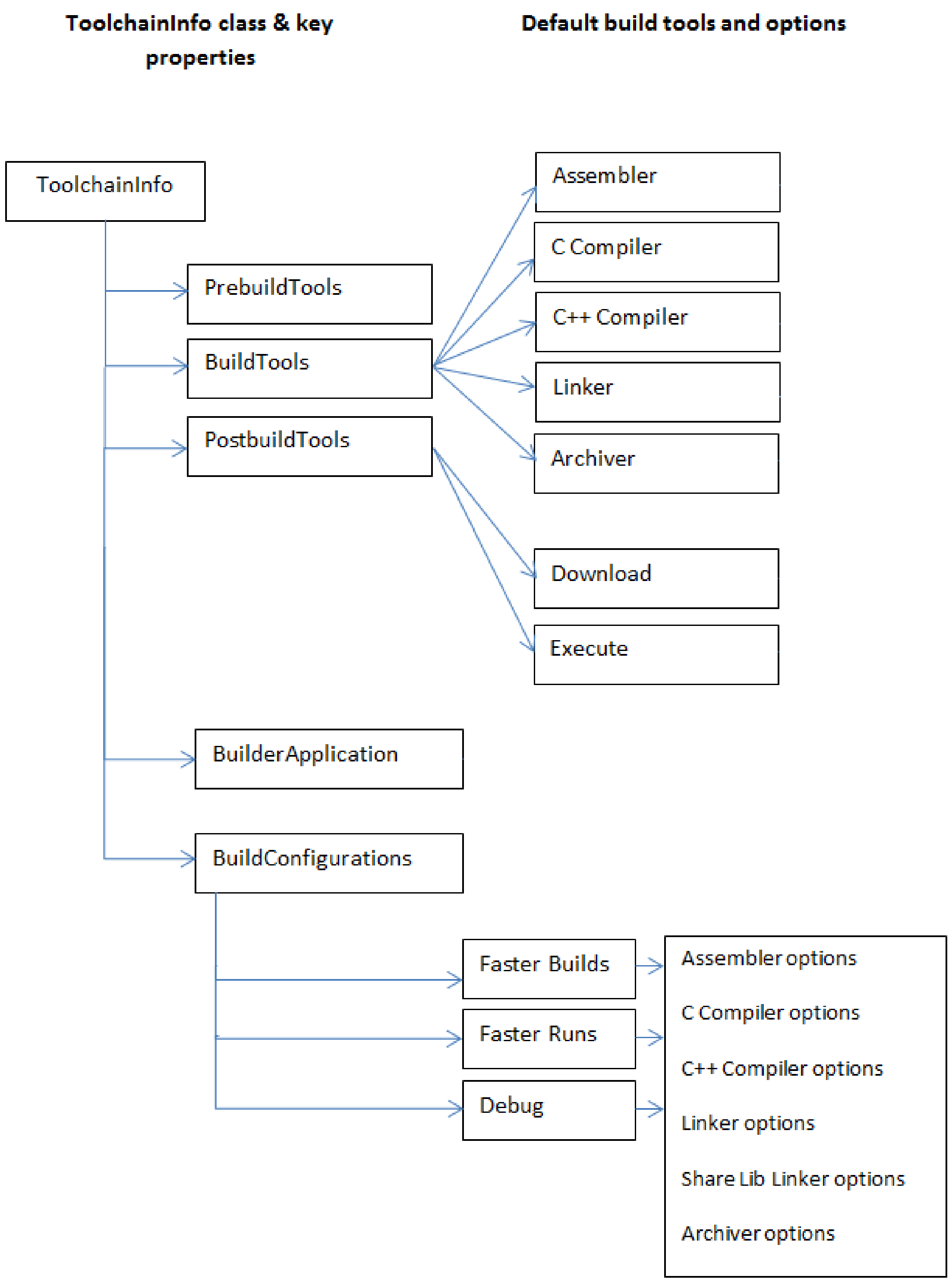
- `coder.make.ToolchainInfo.BuildTools`
- `coder.make.ToolchainInfo.PostbuildTools`

The “get and define” approach is shown in:

- “Toolchain Definition File with Commentary”
- Tutorial example: “Adding a Custom Toolchain” tutorial

The alternative “create a new” approach is shown in “Create a New BuildTool” on page 3-131.

The following illustration shows the relationship between the default `BuildTool` objects and `ToolchainInfo`.


ToolchainInfo class & key properties
Default build tools and options
ToolchainInfo
PrebuildTools
BuildTools
PostbuildTools
BuilderApplication
BuildConfigurations
Assembler
C Compiler
C++ Compiler
Linker
Archiver
Download
Execute
Faster Builds
Faster Runs
Debug
Assembler options
C Compiler options
C++ Compiler options
Linker options
Share Lib Linker options
Archiver options

Construction

`h = coder.make.BuildTool(bldtl_name)` creates a `coder.make.BuildTool` object and sets its `Name` property.

Input Arguments

`bldtl_name` — Build tool name
string

Build tool name, specified as a string.

Data Types: `char`

Output Arguments

`h` — Object handle
variable

Object handle for a `coder.make.BuildTool` object, specified as a variable.

Example: `tool`

Properties

`Command` — Build tool command or command macro

Represents the build tool command using:

- An optional macro name, such as: `CC`.
- The system call (command) that starts the build tool, such as: `gcc`.

The macro name and system call appear together in the generated makefile. For example: `CC = gcc`

Assigning a value to this property is optional.

You can use the following methods with `Command`:

- `coder.make.BuildTool.getCommand`
- `coder.make.BuildTool.setCommand`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`Directives` — Tool-specific directives

Defines any tool-specific directives, such as `-D` for preprocessor defines. Assigning a value to this property is optional.

You can use the following methods with `Directives`:

- `coder.make.BuildTool.addDirective`
- `coder.make.BuildTool.getDirective`
- `coder.make.BuildTool.setDirective`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`FileExtensions` — Tool-specific file extensions

Defines any tool-specific file extensions. This value is optional.

You can use the following methods with `FileExtensions`:

- `coder.make.BuildTool.addFileExtension`
- `coder.make.BuildTool.getFileExtension`
- `coder.make.BuildTool.setFileExtension`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`Name` — Name of build tool

Defines the name of the build tool.

You can use the following methods with `Name`.

- `coder.make.BuildTool.getName`
- `coder.make.BuildTool.setName`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`Path` — Tool-specific paths

Defines any tool-specific paths. If the command is on the system path, this value is optional.

You can use the following methods with `Path`:

- `coder.make.BuildTool.getPath`
- `coder.make.BuildTool.setPath`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

Methods

Copy Semantics

Handle. To learn how handle classes affect copy operations, see Copying Objects in the MATLAB documentation.

Example

Get a default build tool and set its properties

The `intel_tc.m` file from "Adding a Custom Toolchain", uses the following lines to get a default build tool, `C Compiler`, from a `ToolchainInfo` object called `tc`, and then sets its properties.

```
% ------------------------------
% C Compiler
% ------------------------------

tool = tc.getBuildTool('C Compiler');

tool.setName('Intel C Compiler');
tool.setCommand('icl');
tool.setPath('');

tool.setDirective('IncludeSearchPath','-I');
tool.setDirective('PreprocessorDefine','-D');
tool.setDirective('OutputFlag','-Fo');
tool.setDirective('Debug','-Zi');

tool.setFileExtension('Source','.c');
tool.setFileExtension('Header','.h');
tool.setFileExtension('Object','.obj');

tool.setCommandPattern('|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|');
```

The following examples show the same “get and define” approach in more detail:

- “Toolchain Definition File with Commentary”
- Tutorial example: “Adding a Custom Toolchain” tutorial

Create a New BuildTool

To create a new build tool:

1. Create a file that defines a `BuildTool` object, such as `createBuildTool_1.m` or `createBuildTool_2`.
2. Create a file like `addBuildToolToToolchainInfo.m`, that:
   - Creates a `ToolchainInfo` object, or uses an existing one.
   - Creates a `BuildTool` object from `createBuildTool_1.m` or `createBuildTool_2`.
   - Adds the `BuildTool` object to the `ToolchainInfo` object.
3. Run `addBuildToolToToolchainInfo.m`.

Refer to the following examples of `addBuildToolToToolchainInfo.m`, `createBuildTool_1.m`, and `createBuildTool_2`.

addBuildToolToToolchainInfo.m

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Adding a build tool to ToolchainInfo
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
% Create a toolchain object
h = coder.make.ToolchainInfo();

% User function for creating and populating a build tool
tool = createBuildTool_1();
% or tool = createBuildTool_2();

% Add the build tool to ToolchainInfo
h.addBuildTool('My C Compiler',tool);
```

createBuildTool_1.m

```
function buildToolObj = createBuildTool_1()

toolinfo.Name                         = 'My GNU C Compiler';
toolinfo.Language                     = 'C';

toolinfo.Command.Macro                = 'CC';
toolinfo.Command.Value                = 'gcc';

toolinfo.Path.Macro                   = 'CC_PATH';
toolinfo.Path.Value                   = '';

toolinfo.OptionsRegistry              = {'My C Compiler','MY_CFLAGS'};

% Key name of this directive
toolinfo.Directives(1).Key            = 'IncludeSearchPath';

% Macro of this directive (directives can have empty macros)
toolinfo.Directives(1).Macro          = '';

% Value of this directive
toolinfo.Directives(1).Value          = '-I';

toolinfo.Directives(2).Key            = 'PreprocessorDefine';
toolinfo.Directives(2).Macro          = '';
toolinfo.Directives(2).Value          = '-D';

toolinfo.Directives(3).Key            = 'Debug';
toolinfo.Directives(3).Macro          = 'CDEBUG';
toolinfo.Directives(3).Value          = '-g';

toolinfo.Directives(4).Key            = 'OutputFlag';
toolinfo.Directives(4).Macro          = 'C_OUTPUT_FLAG';
toolinfo.Directives(4).Value          = '-o';

% Key name of this file extension
toolinfo.FileExtensions(1).Key        = 'Source';

% Macro of this file extension
toolinfo.FileExtensions(1).Macro      = 'C_EXT';

% Value of this file extension
toolinfo.FileExtensions(1).Value      = '.c';

toolinfo.FileExtensions(2).Key        = 'Header';
toolinfo.FileExtensions(2).Macro      = 'H_EXT';
toolinfo.FileExtensions(2).Value    = '.h';

toolinfo.FileExtensions(3).Key      = 'Object';
toolinfo.FileExtensions(3).Macro    = 'OBJ_EXT';
toolinfo.FileExtensions(3).Value    = '.obj';

toolinfo.DerivedFileExtensions      = {'$(OBJ_EXT)'};
% '*' means all outputs are supported
toolinfo.SupportedOutputs           = {'*'};


% put actual extension (e.g. '.c') or keyname if already registered
% under 'FileExtensions'
toolinfo.InputFileExtensions        = {'Source'};
toolinfo.OutputFileExtensions       = {'Object'};

% Create a build tool object and populate it with the above data
buildToolObj = createAndpopulateBuildTool(toolinfo);

function buildToolObj = createAndpopulateBuildTool(toolinfo)

% -------------------------
% Construct a BuildTool
% -------------------------
buildToolObj = coder.make.BuildTool();

% -------------------------
% Set general properties
% -------------------------
buildToolObj.Name              = toolinfo.Name;
buildToolObj.Language          = toolinfo.Language;
buildToolObj.Command           = coder.make.BuildItem ...
    (toolinfo.Command.Macro,toolinfo.Command.Value);
buildToolObj.Path              = coder.make.BuildItem ...
    (toolinfo.Path.Macro,toolinfo.Path.Value);
buildToolObj.OptionsRegistry   = toolinfo.OptionsRegistry;
buildToolObj.SupportedOutputs  = toolinfo.SupportedOutputs;

% -------------------------
% Directives
% -------------------------
for i = 1:numel(toolinfo.Directives)
    directiveBuildItem = coder.make.BuildItem(...
        toolinfo.Directives(i).Macro,toolinfo.Directives(i).Value);
    buildToolObj.addDirective(toolinfo.Directives(i).Key,directiveBuildItem);
end

% -------------------------
% File extensions
% -------------------------
for i = 1:numel(toolinfo.FileExtensions)
    fileExtBuildItem = coder.make.BuildItem(...
        toolinfo.FileExtensions(i).Macro,toolinfo.FileExtensions(i).Value);
    buildToolObj.addFileExtension(toolinfo.FileExtensions(i).Key,fileExtBuildItem);
end

% -------------------------
% Derived file extensions
% -------------------------
for i = 1:numel(toolinfo.DerivedFileExtensions)
    if buildToolObj.FileExtensions.isKey(toolinfo.DerivedFileExtensions{i})
        buildToolObj.DerivedFileExtensions{end+1} = ...
```

```
            ['$(' buildToolObj.getFileExtension
            (toolinfo.DerivedFileExtensions{i}) ')'];
        else
            buildToolObj.DerivedFileExtensions{end+1} = toolinfo.DerivedFileExtensions{i};
        end
    end

    % -------------------------
    % Command pattern
    % -------------------------
    if isfield(toolinfo,'CommandPattern')
        buildToolObj.CommandPattern = toolinfo.CommandPattern;
    end

    % --------------------------------
    % [Input/Output]FileExtensions
    % --------------------------------
    if isfield(toolinfo,'InputFileExtensions')
        buildToolObj.InputFileExtensions = toolinfo.InputFileExtensions;
    end
    if isfield(toolinfo,'OutputFileExtensions')
        buildToolObj.OutputFileExtensions = toolinfo.OutputFileExtensions;
    end
```

createBuildTool_2.m

```
function buildToolObj = createBuildTool_2()

% -------------------------
% Construct a BuildTool
% -------------------------
buildToolObj = coder.make.BuildTool();

% -------------------------
% Set general properties
% -------------------------
buildToolObj.Name                = 'My GNU C Compiler';
buildToolObj.Language            = 'C';
buildToolObj.Command             = coder.make.BuildItem('CC','gcc');
buildToolObj.Path                = coder.make.BuildItem('CC_PATH','');
buildToolObj.OptionsRegistry     = {'My C Compiler','MY_CFLAGS'};
buildToolObj.SupportedOutputs    = {'*'}; % '*' means all outputs are supported

% -------------------------
% Directives
% -------------------------

directiveBuildItem = coder.make.BuildItem('','-I');
buildToolObj.addDirective('IncludeSearchPath',directiveBuildItem);

directiveBuildItem = coder.make.BuildItem('','-D');
buildToolObj.addDirective('PreprocessorDefine',directiveBuildItem);

directiveBuildItem = coder.make.BuildItem('CDEBUG','-g');
buildToolObj.addDirective('Debug',directiveBuildItem);

directiveBuildItem = coder.make.BuildItem('C_OUTPUT_FLAG','-o');
buildToolObj.addDirective('OutputFlag',directiveBuildItem);

% -------------------------
% File Extensions
% -------------------------
```

```
fileExtBuildItem = coder.make.BuildItem('C_EXT','.c');
buildToolObj.addFileExtension('Source',fileExtBuildItem);

fileExtBuildItem = coder.make.BuildItem('H_EXT','.h');
buildToolObj.addFileExtension('Header',fileExtBuildItem);

fileExtBuildItem = coder.make.BuildItem('OBJ_EXT','.obj');
buildToolObj.addFileExtension('Object',fileExtBuildItem);

% ------------------------
% Others
% ------------------------

buildToolObj.DerivedFileExtensions  = {'$(OBJ_EXT)'};
buildToolObj.InputFileExtensions    = {'Source'};
% put actual extension (e.g. '.c')
% or keyname if already registered under 'FileExtensions'
buildToolObj.OutputFileExtensions   = {'Object'};
% put actual extension (e.g. '.c')
% or keyname if already registered under 'FileExtensions'
```

See Also

`coder.make.ToolchainInfo` | "Toolchain Definition File with Commentary" | `coder.make.BuildTool` | `coder.make.ToolchainInfo.addBuildTool` | `coder.make.ToolchainInfo.getBuildTool` | `coder.make.ToolchainInfo.removeBuildTool` | `coder.make.ToolchainInfo.setBuildTool`

Related Examples

- "Adding a Custom Toolchain"

coder.make.ToolchainInfo class

Package: coder.make

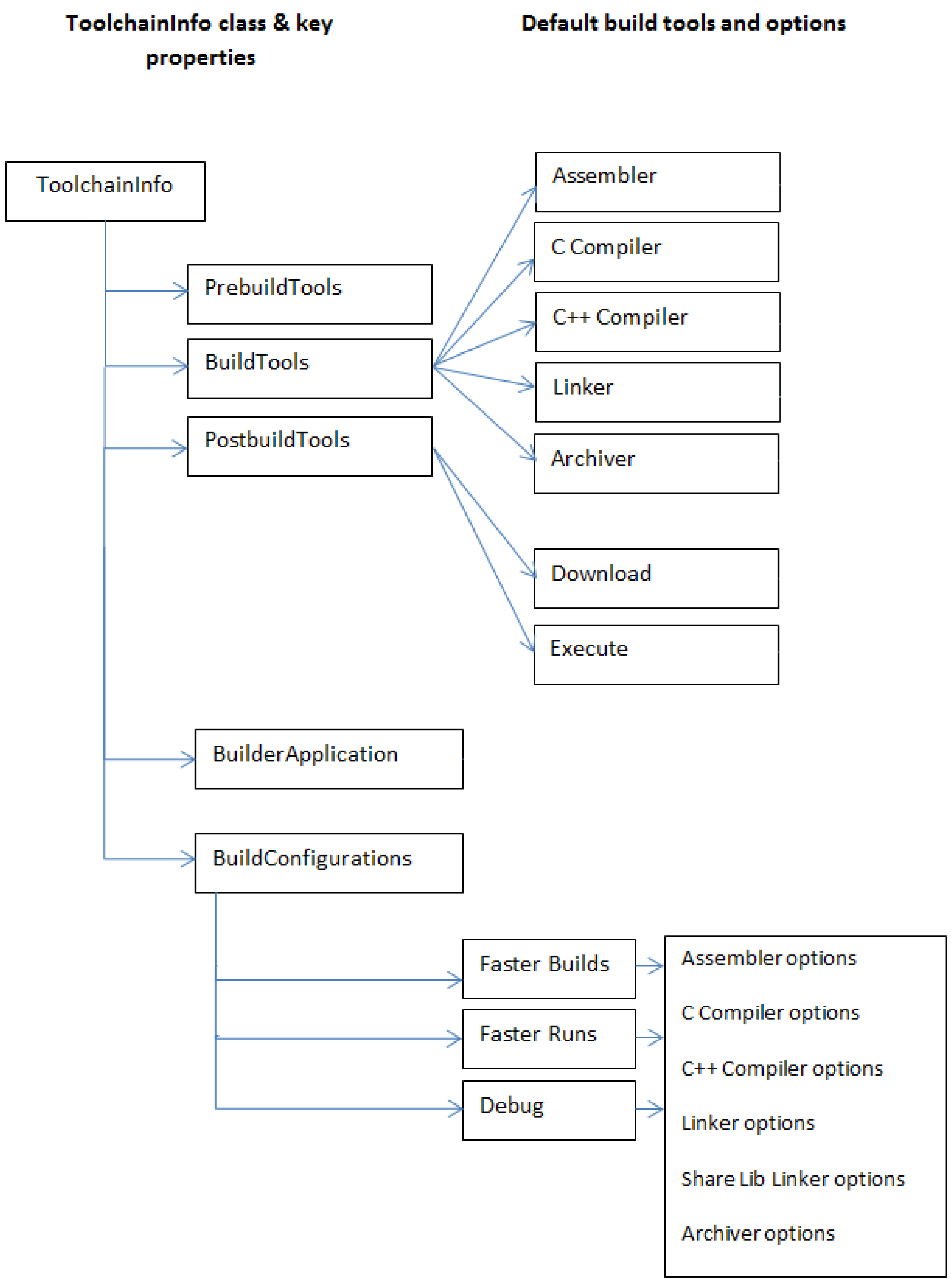
Represent custom toolchain

Description

Use `coder.make.ToolchainInfo` to define and register a new set of software build tools (*toolchain*) with MathWorks code generation products.

A `coder.make.ToolchainInfo` object contains:

- `coder.make.BuildTool` objects that can describe each build tool
- `coder.make.BuildConfiguration` objects that can apply sets of options to the build tools


ToolchainInfo class & key properties
Default build tools and options
ToolchainInfo
PrebuildTools
BuildTools
PostbuildTools
BuilderApplication
BuildConfigurations
Assembler
C Compiler
C++ Compiler
Linker
Archiver
Download
Execute
Faster Builds
Faster Runs
Debug
Assembler options
C Compiler options
C++ Compiler options
Linker options
Share Lib Linker options
Archiver options

Construction

`h = coder.make.ToolchainInfo` creates a default ToolchainInfo object and assigns it to a handle, `h`.

The default `ToolchainInfo` object includes `BuildTool` objects and configurations for C, C++, and gmake:

- The default value of `SupportedLanguages`, `C/C++`, adds `BuildTool` and `BuildConfiguration` objects for C and C++ compilers to `ToolchainInfo`.
- The default value of `BuildArtifact`, `gmake`, adds a `BuildTool` object for gmake to `ToolchainInfo.BuilderApplication`.

You can use the following arguments to override these defaults when you create the `ToolchainInfo` object, not afterwards.

`h = coder.make.ToolchainInfo(SupportedLanguages,value1, BuildArtifact,value2)` overrides the `SupportedLanguages` or `BuildArtifact` defaults.

Each property is optional. Each property requires a corresponding value.

Input Arguments

`SupportedLanguages`

The property name. For more information, see SupportedLanguages.

`value1` — Supported language or languages
`C/C++` (default) | `C` | `C++` | `Asm/C` | `Asm/C/C++` | `Asm/C++`

Supported language or languages, specified as a scalar.

`BuildArtifact` — Name of BuildArtifact property

The property name. For more information, see BuildArtifact.

`value2` — Value of BuildArtifact property
`gmake` (default) | `gmake makefile` | `nmake` | `nmake makefile`

Values for the `BuildArtifact` property, specified as a scalar.

Output Arguments

h — ToolchainInfo object handle

A coder.make.ToolchainInfo object, specified using an object handle, such as `h`. To create `h`, enter `h = coder.make.ToolchainInfo` in a MATLAB Command Window.

Properties

`Attributes` — Custom attributes of toolchain

Custom attributes of the toolchain

Add custom attributes required by the toolchain and specify their default values.

By default, the list of custom attributes is empty.

Attributes returns a `coder.make.util.UnorderedList`.

For example, the `intel_tc.m` file from “Adding a Custom Toolchain”, defines the following custom attributes:

```
tc.addAttribute('TransformPathsWithSpaces');
tc.addAttribute('RequiresCommandFile');
tc.addAttribute('RequiresBatchFile');
```

To display the `Attributes` list from that example in a MATLAB Command Window, enter:

```
h = intel_tc;
h.Attributes
```

```
ans =


# -------------------
# "Attributes" List
# -------------------
RequiresBatchFile        = true
RequiresCommandFile      = true
```

```
TransformPathsWithSpaces = true
```

Use the following methods with `Attributes`:

- `coder.make.ToolchainInfo.addAttribute`
- `coder.make.ToolchainInfo.getAttribute`
- `coder.make.ToolchainInfo.getAttributes`
- `coder.make.ToolchainInfo.isAttribute`
- `coder.make.ToolchainInfo.removeAttribute`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`BuildArtifact` — Type of makefile or build artifact

The type of makefile (build artifact) MATLAB Coder uses during the software build process.

Initialize this property when you create `coder.make.ToolchainInfo`. Use the default value, `gmake makefile`, or override the default value using a name-value pair argument, as described in “Construction” on page 3-138.

For example:

```
h = coder.make.ToolchainInfo('BuildArtifact','nmake');
```

The values can be:

- `'gmake'` or `'gmake makefile'` — The GNU make utility
- `'nmake'` or `'nmake makefile'` — The Windows make utility

For example, to display the value of `BuildArtifact` in a MATLAB Command Window, enter:

```
h = coder.make.ToolchainInfo;
h.BuildArtifact
```

```
ans  =
gmake makefile
```

`ToolchainInfo` uses the value of the `BuildArtifact` property to create a `BuildTool` object for the build artifact in `coder.make.ToolchainInfo.BuilderApplication`.

The `intel_tc.m` file from the "Adding a Custom Toolchain"example uses the following line to set the value of `BuildArtifact`:

```
tc = coder.make.ToolchainInfo('BuildArtifact','nmake makefile');
```

There are no methods to use with `BuildArtifact`.

Attributes:

`GetAccess`	`public`
`SetAccess`	`protected`

`BuildConfigurations` — List of build configurations

List of build configurations

Each entry in this list is a `coder.make.BuildConfiguration` object.

For example, the `intel_tc.m` file from "Adding a Custom Toolchain", uses the following lines to define the build configurations:

```
cfg = tc.getBuildConfiguration('Faster Builds');
cfg.setOption('C Compiler',horzcat(cCompilerOpts,optimsOffOpts));
cfg.setOption('C++ Compiler',horzcat(cppCompilerOpts,optimsOffOpts));
cfg.setOption('Linker',linkerOpts);
cfg.setOption('Shared Library Linker',sharedLinkerOpts);
cfg.setOption('Archiver',archiverOpts);

cfg = tc.getBuildConfiguration('Faster Runs');
cfg.setOption('C Compiler',horzcat(cCompilerOpts,optimsOnOpts));
cfg.setOption('C++ Compiler',horzcat(cppCompilerOpts,optimsOnOpts));
cfg.setOption('Linker',linkerOpts);
cfg.setOption('Shared Library Linker',sharedLinkerOpts);
cfg.setOption('Archiver',archiverOpts);

cfg = tc.getBuildConfiguration('Debug');
cfg.setOption('C Compiler',horzcat(cCompilerOpts,optimsOffOpts,debugFlag.CCompiler));
cfg.setOption('C++ Compiler',horzcat(cppCompilerOpts,optimsOffOpts,debugFlag.CppCompiler));
cfg.setOption('Linker',horzcat(linkerOpts,debugFlag.Linker));
cfg.setOption('Shared Library Linker',horzcat(sharedLinkerOpts,debugFlag.Linker));
cfg.setOption('Archiver',horzcat(archiverOpts,debugFlag.Archiver));

tc.setBuildConfigurationOption('all','Download','');
tc.setBuildConfigurationOption('all','Execute','');
tc.setBuildConfigurationOption('all','Make Tool','-f $(MAKEFILE)');
```

To display the `BuildConfigurations` list from that example in a MATLAB Command Window, enter:

```
h = intel_tc;
h.BuildConfigurations
```

```
ans =


# ----------------------------
# "BuildConfigurations" List
# ----------------------------
Debug          = <coder.make.BuildConfiguration>
Faster Builds  = <coder.make.BuildConfiguration>
Faster Runs    = <coder.make.BuildConfiguration>
```

Use the following methods with `BuildConfigurations`:

- `coder.make.ToolchainInfo.getBuildConfiguration`
- `coder.make.ToolchainInfo.removeBuildConfiguration`
- `coder.make.ToolchainInfo.setBuildConfiguration`

Attributes:

GetAccess	public
SetAccess	public

`BuildTools` — List of build tools in toolchain

The list of build tools in the toolchain.

Each entry in this list is a `coder.make.BuildTool` object.

When you initialize `ToolchainInfo`, the `SupportedLanguages` property determines which build tools are created in `BuildTools`. For more information, see `SupportedLanguages` or "Construction" on page 3-138.

The `BuildTool` objects ToolchainInfo can create based on the `SupportedLanguages` are:

- Assembler
- C Compiler

- C++ Compiler
- Linker
- Archiver

For example, the `intel_tc.m` file from “Adding a Custom Toolchain”, uses the following lines to get and update one of the `BuildTool` objects:

```
% -----------------------------
% C Compiler
% -----------------------------

tool = tc.getBuildTool('C Compiler');

tool.setName('Intel C Compiler');
tool.setCommand('icl');
tool.setPath('');

tool.setDirective('IncludeSearchPath','-I');
tool.setDirective('PreprocessorDefine','-D');
tool.setDirective('OutputFlag','-Fo');
tool.setDirective('Debug','-Zi');

tool.setFileExtension('Source','.c');
tool.setFileExtension('Header','.h');
tool.setFileExtension('Object','.obj');

tool.setCommandPattern('|>TOOL<| |>TOOL_OPTIONS<| |>OUTPUT_FLAG<||>OUTPUT<|');
```

To display the `BuildTools` list from that example in a MATLAB Command Window, enter:

```
h = intel_tc;
h.BuildTools
```

```
ans =


# -------------------
# "BuildTools" List
# -------------------
C Compiler   = <coder.make.BuildTool>
C++ Compiler = <coder.make.BuildTool>
Archiver     = <coder.make.BuildTool>
Linker       = <coder.make.BuildTool>
MEX Tool     = <coder.make.BuildTool>
```

Use the following methods with `BuildTools`:

- `coder.make.ToolchainInfo.addBuildTool`

- `coder.make.ToolchainInfo.getBuildTool`
- `coder.make.ToolchainInfo.removeBuildTool`
- `coder.make.ToolchainInfo.setBuildTool`

Attributes:

GetAccess	public
SetAccess	public

`BuilderApplication` — Properties of build tool

Properties of the build tool that runs the makefile or build artifact

`ToolchainInfo` uses the value of the `BuildArtifact` property to create a `BuildTool` object for `coder.make.ToolchainInfo.BuilderApplication`, as described in "Construction" on page 3-138.

For example, the `intel_tc.m` file from "Adding a Custom Toolchain", uses the following lines to set the `BuildArtifact` and update `BuilderApplication` objects:

```
h = coder.make.ToolchainInfo('BuildArtifact','nmake');
```

To display the value of `BuilderApplication` from that example in a MATLAB Command Window, enter:

```
h.BuilderApplication
```

```
ans =

##############################################
# Build Tool: NMAKE Utility
##############################################

Language               : ''
OptionsRegistry        : {'Make Tool','MAKE_FLAGS'}
InputFileExtensions    : {}
OutputFileExtensions   : {}
DerivedFileExtensions  : {}
SupportedOutputs       : {'*'}
CommandPattern         : '|>TOOL<| |>TOOL_OPTIONS<|'

# ---------
# Command
# ---------
MAKE = nmake
MAKE_PATH  =

# ------------
# Directives
# ------------
Comment               = #
DeleteCommand         = @del
DisplayCommand        = @echo
FileSeparator         = \
ImpliedFirstDependency = $<
ImpliedTarget         = $@
IncludeFile           = !include
LineContinuation      = \
MoveCommand           = @mv
ReferencePattern      = \$\($1\)
RunScriptCommand      = @cmd /C

# -----------------
# File Extensions
# -----------------
Makefile = .mk
```

Use the `coder.make.ToolchainInfo.setBuilderApplication` method with `BuilderApplication`.

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`InlinedCommands` — Commands toolchain needs to inline within generated makefile

Commands the toolchain needs to inline within the generated makefile

Specify inlined commands to insert verbatim into the makefile. The default value is `empty`.

The datatype is String.

For example, to display and then update the value of the `InlinedCommands` property, use the MATLAB Command Window to enter:

```
h.InlinedCommands
```

```
ans  =

     ''
```

```
h.InlinedCommands =  '!include <ntwin32.mak>';
h.InlinedCommands
```

```
!include <ntwin32.mak>
```

The “Adding a Custom Toolchain” example does not include the `InlinedCommands` property.

There are no methods to use with `InlinedCommands`.

Attributes:

GetAccess	public
SetAccess	public

`MATLABCleanup` — MATLAB cleanup commands

MATLAB cleanup commands

Specify MATLAB commands or scripts to perform cleanup routines specific to this toolchain. Use commands or scripts that can be invoked from the MATLAB Command Window. The default value is empty.

The datatype is a cell array of strings.

For example, to display and then update the value of the `MATLABSetup` and `MATLABCleanup` properties, use the MATLAB Command Window to enter:

```
h = coder.make.ToolchainInfo;
h.MATLABSetup;
h.MATLABCleanup;
h.MATLABSetup{1}    = sprintf('if ispc \n origTMP=getenv(''TMP''); \n setenv(''TMP'',''C:\\TEMP'');\nend');
h.MATLABCleanup{1}  = sprintf('if ispc \n setenv(''TMP'',origTMP); \nend');
```

The following list illustrates where this property fits in the sequence of operations :

1. MATLAB Setup
2. Shell Setup
3. Prebuild
4. Build (assembler, compilers, linker, archiver)
5. Postbuild
   a. Download
   b. Execute
6. Shell Cleanup

7 MATLAB Cleanup

The “Adding a Custom Toolchain” example does not include the `MATLABCleanup` property.

There are no methods to use with `MATLABCleanup`.

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`MATLABSetup` — MATLAB setup commands

MATLAB setup commands

Specify MATLAB commands or scripts to perform setup routines specific to this toolchain. Use commands or scripts that can be invoked from the MATLAB Command Window. The default value is empty.

The datatype is a cell array of strings.

For example, to display and then update the value of the `MATLABSetup` and `MATLABCleanup` properties, use the MATLAB Command Window to enter:

```
h = coder.make.ToolchainInfo;
h.MATLABSetup;
h.MATLABCleanup;
h.MATLABSetup{1}    = sprintf('if ispc \n origTMP=getenv(''TMP''); \n setenv(''TMP'',''C:\\TEMP'');\nend');
h.MATLABCleanup{1}  = sprintf('if ispc \n setenv(''TMP'',origTMP); \nend');
```

The following list illustrates where this property fits in the sequence of operations :

1. MATLAB Setup
2. Shell Setup
3. Prebuild
4. Build (assembler, compilers, linker, archiver)
5. Postbuild
   a. Download
   b. Execute
6. Shell Cleanup

7 MATLAB Cleanup

The “Adding a Custom Toolchain” example does not include the `MATLABSetup` property.

There are no methods to use with `MATLABCleanup`.

Attributes:

GetAccess	public
SetAccess	public

`Macros` — List of custom macros

List of custom macros that contains macro names and values

The list is a `coder.make.util.OrderedList` of `coder.make.BuildItem` objects.

By default this list is empty. For example:

```
h = coder.make.ToolchainInfo;
h.Macros
```

```
ans =


# ---------------
# "Macros" List
# ---------------
(empty)
```

ToolchainInfo uses macros in two ways:

- It writes macros that are used by the current build to the makefile as variables. For example:

  ```
  TI_INSTALL    =  C:\Program Files\CCSv4
  TI_C2000_TOOLS   =  $(TI_INSTALL)\tools\compiler\c2000\bin
  ```
- When the custom toolchain has been registered, validate expands the complete path provided by a macro, including macros contained within macros. For example, when ToolchainInfo validates the path in the following compiler information, it expands both `TI_C2000_TOOLS` and `TI_INSTALL`:

  ```
  Command = 'cl2000'
  ```

```
   Path = '$(TI_C2000_TOOLS)'
```

The default value of `Macros` is an empty list.

The datatype is `coder.make.util.OrderedList` of `coder.make.BuildItem` objects.

For example, the `intel_tc.m` file from “Adding a Custom Toolchain”uses the following lines to add macros to `Macros`:

```
% ------------------------------
% Macros
% ------------------------------
tc.addMacro('MW_EXTERNLIB_DIR',['$(MATLAB_ROOT)\extern\lib\' tc.Platform '\microsoft']);
tc.addMacro('MW_LIB_DIR',['$(MATLAB_ROOT)\lib\' tc.Platform]);
tc.addMacro('CFLAGS_ADDITIONAL','-D_CRT_SECURE_NO_WARNINGS');
tc.addMacro('CPPFLAGS_ADDITIONAL','-EHs -D_CRT_SECURE_NO_WARNINGS');
tc.addMacro('LIBS_TOOLCHAIN','$(conlibs)');
tc.addMacro('CVARSFLAG','');

tc.addIntrinsicMacros({'ldebug','conflags','cflags'});
```

With that example, to see the corresponding property values in a MATLAB command window, enter:

```
h = intel_tc;
h.Macros
```

```
ans =


# ---------------
# "Macros" List
# ---------------
MW_EXTERNLIB_DIR    = $(MATLAB_ROOT)\extern\lib\win64\microsoft
MW_LIB_DIR          = $(MATLAB_ROOT)\lib\win64
CFLAGS_ADDITIONAL   = -D_CRT_SECURE_NO_WARNINGS
CPPFLAGS_ADDITIONAL = -EHs -D_CRT_SECURE_NO_WARNINGS
LIBS_TOOLCHAIN      = $(conlibs)
CVARSFLAG           =
ldebug              =
conflags            =
cflags              =
```

Use the following methods with this property:

- `coder.make.ToolchainInfo.addMacro`
- `coder.make.ToolchainInfo.getMacro`

- `coder.make.ToolchainInfo.removeMacro`
- `coder.make.ToolchainInfo.setMacro`
- `coder.make.ToolchainInfo.addIntrinsicMacros`
- `coder.make.ToolchainInfo.removeIntrinsicMacros`

Attributes:

GetAccess	public
SetAccess	public

`Name` — Unique name for toolchain definition

Unique name for the toolchain definition

Specify the full name of the toolchain. This name also appears as one of the **Toolchain** parameter options on the **Hardware** tab of the project build settings. The default value is empty. The recommended format is:

`name version` `|` *`build artifact`* `(`*`platform`*`)`

The datatype is String.

For example, the `intel_tc.m` file from “Adding a Custom Toolchain”uses the following line to define the value of `Name`:

```
tc.Name             = 'Intel v12.1 | nmake makefile (64-bit Windows)';
```

With that example, to see the corresponding property values in the MATLAB Command Window, enter:

```
h = intel_tc;
h.Name


ans  =

Intel v12.1 | nmake makefile (64-bit Windows)
```

Attributes:

GetAccess	public
SetAccess	public

`Platform` — Specify supported platform

Specify the supported platform

Specify the platform upon which the toolchain will be used. The default value is the current platform. Supported values are `win32`, `win64`, `maci64`, `glnxa64`, and `''`. A `''` value means the toolchain supported on all platforms.

Create a separate ToolchainInfo for each platform.

The datatype is String.

This property does not have any associated methods. Assign the value directly to the `Platform`.

For example, the `intel_tc.m` file from “Adding a Custom Toolchain”uses the following line to define the value of `Platform`:

```
tc.Platform         = 'win64';
```

With that example, to see the corresponding property values in a MATLAB Command Window, enter:

```
h = intel_tc;
h.Platform


ans  =

win64
```

Attributes:

GetAccess	public
SetAccess	public

`PostbuildTools` — List of tools used after linker archiver

The list of tools used after the linker/archiver are invoked.

The list is a `coder.make.util.OrderedList` of `coder.make.BuildTool` objects.

By default the list contains two `BuildTool` objects: `Download` and `Execute`.

To see the corresponding property values in the MATLAB Command Window, enter:

```
h = coder.make.ToolchainInfo;
h.PostbuildTools


ans =


# -----------------------
# "PostbuildTools" List
# -----------------------
Download = <coder.make.BuildTool>
Execute  = <coder.make.BuildTool>
```

The “Adding a Custom Toolchain” example does not include the `PostbuildTools` property.

Use the following methods with this property:

- `coder.make.ToolchainInfo.addPostbuildTool`
- `coder.make.ToolchainInfo.getPostbuildTool`
- `coder.make.ToolchainInfo.removePostbuildTool`
- `coder.make.ToolchainInfo.setPostbuildTool`

Attributes:

`Download`	`public`
`Execute`	`public`

`PrebuildTools` — List of tools used before compiling source files

The list of tools used before compiling the source files into object files.

The list is a `coder.make.util.OrderedList` of `coder.make.BuildTool` objects.

By default this list is empty. For example:

```
h.PrebuildTools


ans =
# ----------------------
# "PrebuildTools" List
# ----------------------
(empty)
```

The “Adding a Custom Toolchain” example does not include the `PrebuildTools` property.

Use the following methods with this property:

- `coder.make.ToolchainInfo.addPrebuildTool`
- `coder.make.ToolchainInfo.getPrebuildTool`
- `coder.make.ToolchainInfo.removePrebuildTool`
- `coder.make.ToolchainInfo.setPrebuildTool`

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`Revision` — Assign revision number to ToolchainInfo

Assign revision number to ToolchainInfo

The author of the toolchain definition file can use this information to differentiate one version of the file from another. The default value is `1.0`.

The datatype is String.

This property does not have any associated methods. Assign the value directly to the `Revision`.

For example:

```
h.Revision


ans  =

1.0
```

```
h.Revision = '2.0';
h.Revision


ans  =

2.0
```

Attributes:

GetAccess	public
SetAccess	public

`ShellCleanup` — Shell scripts that clean up toolchain

Shell scripts that clean up the toolchain

Specify shell commands or scripts to perform cleanup routines specific to this toolchain. Use commands or scripts that can be invoked from the system command environment. The default value is empty.

The datatype is a Cell array of strings. Each string is a shell cleanup command.

If ToolchainInfo invokes a setup routine, you can use a corresponding set of cleanup routines to restore the system environment to its original settings. For example, if a setup routine added environment variables and folders to the system path, you can use a cleanup routine to remove them.

For example:

```
>> h.ShellCleanup

ans  =

     []

>> h.ShellCleanup = 'call "cleanup_mssdk71.bat"';

>> h.ShellCleanup

ans =

    'call "cleanup_mssdk71.bat"'
```

The following list illustrates where this property fits in the sequence of operations :

1. MATLAB Setup
2. Shell Setup
3. Prebuild
4. Build (assembler, compilers, linker, archiver)
5. Postbuild
    a. Download
    b. Execute
6. Shell Cleanup
7. MATLAB Cleanup

The "Adding a Custom Toolchain" example does not include the `ShellCleanup` property.

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`ShellSetup` — Shell scripts that set up toolchain

Shell scripts that set up the toolchain

Specify shell commands or scripts to perform setup routines specific to this toolchain. Use commands or scripts that can be invoked from the system command environment. The default value is empty.

The datatype is a Cell array of strings. Each string is a shell setup command.

If ToolchainInfo invokes a setup routine, you can use a corresponding set of cleanup routines to restore the system environment to its original settings. For example, if a setup routine added environment variables and folders to the system path, you can use a cleanup routine to remove them.

For example:

```
>> h.ShellSetup
```

```
ans  =

     []

>> h.ShellSetup = 'call "setup_mssdk71.bat"';

>> h.ShellSetup

ans =

    'call "setup_mssdk71.bat"'
```

The `intel_tc.m` file in "Adding a Custom Toolchain" uses the following lines to set the value of `ShellSetup`:

```
% ------------------------------
% Setup
% ------------------------------
% Below we are using %ICPP_COMPILER12% as root folder where Intel Compiler is
% installed. You can either set an environment variable or give full path to the
% compilervars.bat file
tc.ShellSetup{1} = 'call %ICPP_COMPILER12%\bin\compilervars.bat intel64';
```

With that example, to see the corresponding property values in the MATLAB Command Window, enter:

```
h = intel_tc;
h.ShellSetup


ans =

    'call %ICPP_COMPILER12%\bin\compilervars.bat intel64'
```

The following list illustrates where this property fits in the sequence of operations :

1. MATLAB Setup
2. Shell Setup
3. Prebuild
4. Build (assembler, compilers, linker, archiver)
5. Postbuild
   a. Download

   b Execute
6 Shell Cleanup
7 MATLAB Cleanup

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`SupportedLanguages` — Create BuildTool objects for specific languages

Create `BuildTool` objects for specific languages

Initializing `ToolchainInfo` creates `BuildTool` objects for the language or set of languages specified by SupportedLanguages.

If you do not specify a value for SupportedLanguages, the default value is `'C/C++'`. This adds `BuildTool` objects for a C compiler and a C++ compiler to the other `BuildTool` objects in ToolchainInfo.

To override the default, use a name-value pair to specify a value for SupportedLanguages when you initialize ToolchainInfo. For example:

```
h = coder.make.ToolchainInfo('SupportedLanguages','C');
```

The value can be: `'C'`, `'C++'`, `'C/C++'`, `'Asm/C'`, `'Asm/C++'`, or `'Asm/C/C++'`.

The SupportedLanguages property does not have any related methods.

The “Adding a Custom Toolchain” example does not include the SupportedLanguages property.

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

`SupportedVersion` — Version of software build tools that ToolchainInfo supports

The version of the software build tools `ToolchainInfo` supports.

The default value is empty.

The datatype is String.

This property does not have any associated methods. Assign the value directly to the `SupportedVersion`.

With the “Adding a Custom Toolchain” example, the value of `SupportedVersion` is defined in the `intel_tc.m` toolchain definition file:

```
tc.SupportedVersion = '12.1';
```

With that example, to see the corresponding property values in the MATLAB command window, enter:

```
h = intel_tc;
h.SupportedVersion


ans  =

12.1
```

Attributes:

`GetAccess`	`public`
`SetAccess`	`public`

Methods

See Also

`coder.make.BuildConfiguration` | `coder.make.BuildItem` | `coder.make.BuildTool`

Related Examples

- “Adding a Custom Toolchain”

More About

- “About coder.make.ToolchainInfo”

Tools — Alphabetical List

Code Replacement Viewer

Explore content of code replacement libraries

Description

The Code Replacement Viewer displays the content of code replacement libraries. Use the tool to explore and choose a library. If your are developing a custom code replacement library, use the tool to verify table entries.

- Argument order is correct.
- Conceptual argument names match code generator naming conventions.
- Implementation argument names are correct.
- Header or source file specification is not missing.
- I/O types are correct.
- Relative priority of entries is correct (highest priority is 0, and lowest priority is 100).
- Saturation or rounding mode specifications are not missing.

If you specify a library name when you open the viewer, the viewer displays the code replacement tables that the library contains. When you select a code replacement table, the viewer displays function and operator code replacement entries that are in that table.

Abbreviated Entry Information

In the middle pane, the viewer displays entries that are in the selected code replacement table, along with abbreviated information for each entry.

Field	Description
Name	Name or identifier of the function or operator being replaced (for example, `cos` or `RTW_OP_ADD`).
Implementation	Name of the implementation function, which can match or differ from **Name**.
NumIn	Number of input arguments.
In1Type	Data type of the first conceptual input argument.
In2Type	Data type of the second conceptual input argument.
OutType	Data type of the conceptual output argument.

Field	Description
Priority	The entry's match priority, relative to other entries of the same name and to the conceptual argument list within the selected code replacement library. The priority can range from 0 to 100, with 0 being the highest priority. The default is 100. If the library provides two implementations for a function or operator, the implementation with the higher priority shadows the one with the lower priority.
UsageCount	Not used.

Detailed Entry Information

In the middle pane, when you select an entry, the viewer displays entry details.

Field	Description
Description	Text description of the table entry (can be empty).
Key	Name or identifier of the function or operator being replaced (for example, `cos` or `RTW_OP_ADD`), and the number of conceptual input arguments.
Implementation	Name of the implementation function, and the number of implementation input arguments.
Implementation type	Type of implementation: `FCN_IMPL_FUNCT` for function or `FCN_IMPL_MACRO` for macro.

Saturation mode	Saturation mode that the implementation function supports. One of:
	`RTW_SATURATE_ON_OVERFLOW`
	`RTW_WRAP_ON_OVERFLOW`
	`RTW_SATURATE_UNSPECIFIED`

Rounding modes	Rounding modes that the implementation function supports. One or more of:
	`RTW_ROUND_FLOOR`
	`RTW_ROUND_CEILING`
	`RTW_ROUND_ZERO`
	`RTW_ROUND_NEAREST`
	`RTW_ROUND_NEAREST_ML`
	`RTW_ROUND_SIMPLEST`

Field	Description
	`RTW_ROUND_CONV` `RTW_ROUND_UNSPECIFIED`
GenCallback file	Not used.
Implementation header	Name of the header file that declares the implementation function.
Implementation source	Name of the implementation source file.
Priority	The entry's match priority, relative to other entries of the same name and to the conceptual argument list within the selected code replacement library. The priority can range from 0 to 100, with 0 being the highest priority. The default is 100. If the library provides two implementations for a function or operator, the implementation with the higher priority shadows the one with the lower priority.
Total Usage Count	Not used.
Entry class	Class from which the current table entry is instantiated.
Conceptual arguments	Name, I/O type (`RTW_IO_OUTPUT` or `RTW_IO_INPUT`), and data type for each conceptual argument.
Implementation	Name, I/O type (`RTW_IO_OUTPUT` or `RTW_IO_INPUT`), data type, and alignment requirement for each implementation argument.

Fixed-Point Entry Information

When you select an operator entry that specifies net slope fixed-point parameters, the viewer displays fixed-point information.

Field	Description
Net slope adjustment factor F	Slope adjustment factor (F) part of the net slope factor, $F2^E$, for net slope table entries. You use this factor with fixed-point multiplication and division replacement to map a range of slope and bias values to a replacement function.
Net fixed exponent E	Fixed exponent (E) part of the net slope factor, $F2^E$, for net slope table entries. You use this fixed exponent with fixed-point

Field	Description
	multiplication and division replacement to map a range of slope and bias values to a replacement function.
Slopes must be the same	Indicates whether code replacement request processing must check that the slopes on arguments (input and output) are equal. You use this information with fixed-point addition and subtraction replacement to disregard specific slope and bias values, and map relative slope and bias values to a replacement function.
Must have zero net bias	Indicates whether code replacement request processing must check that the net bias on arguments is zero. You use this information with fixed-point addition and subtraction replacement to disregard specific slope and bias values, and map relative slope and bias values to a replacement function.

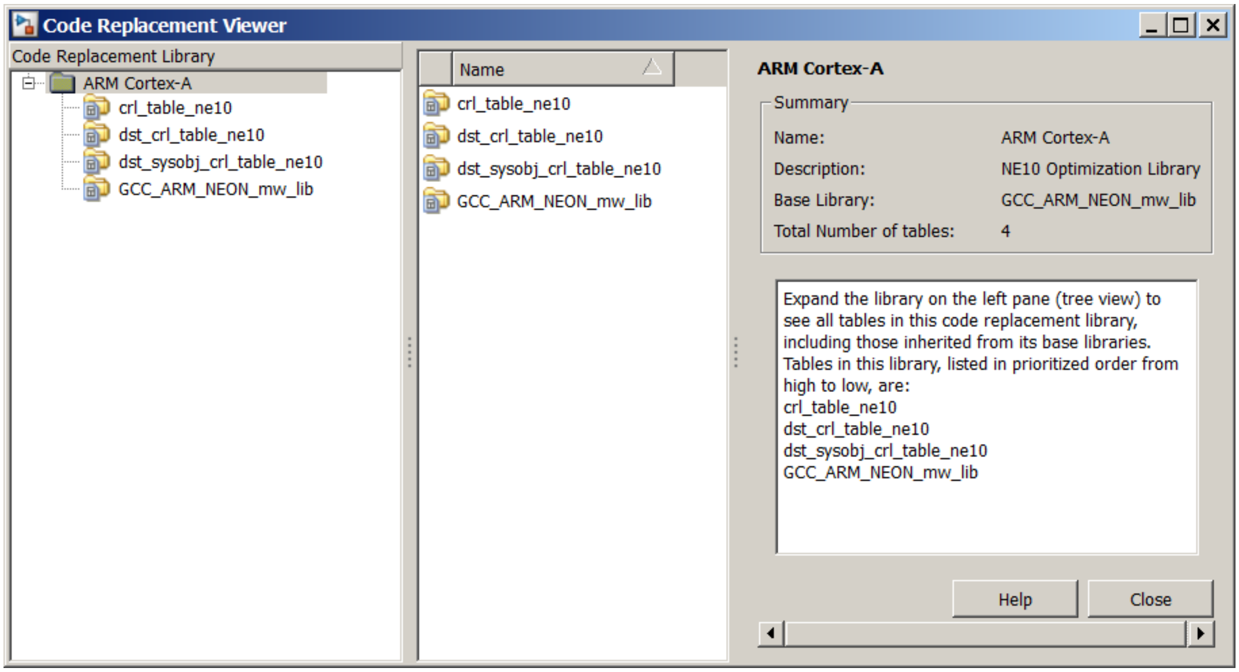
Open the Code Replacement Viewer App

Open from the MATLAB command prompt using `crviewer`.

Examples

Display Contents of Code Replacement Library

```
crviewer('ARM Cortex-A')
```



ARM Cortex-A

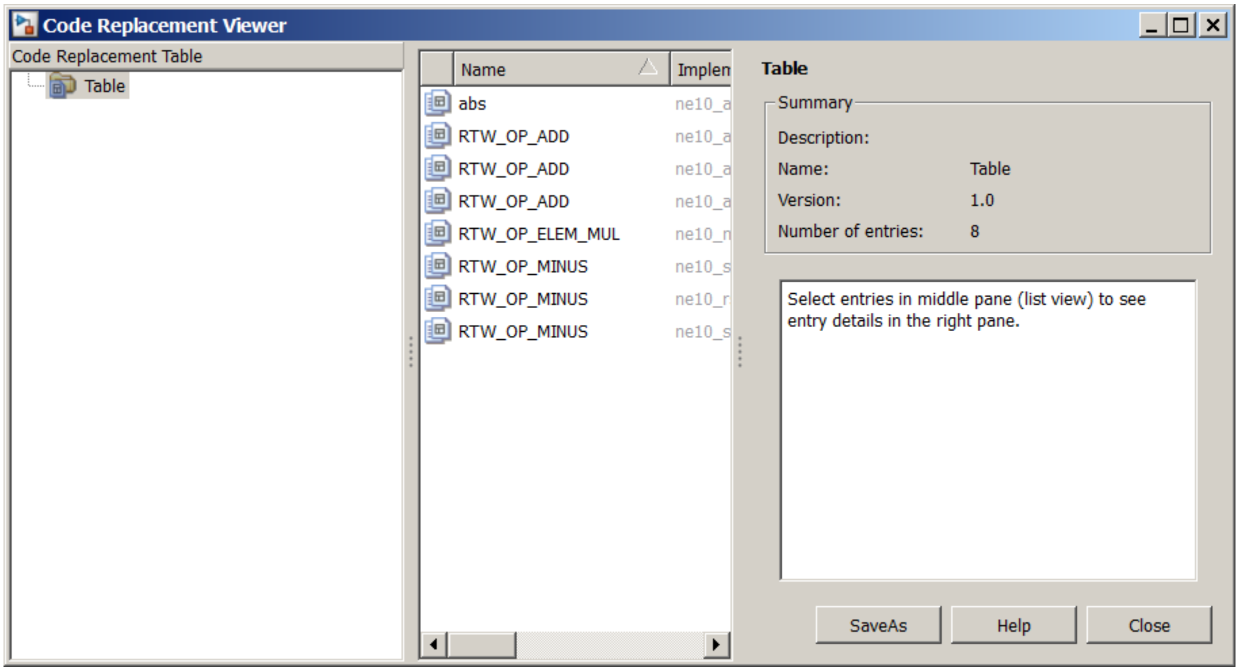
Summary

Name:	ARM Cortex-A
Description:	NE10 Optimization Library
Base Library:	GCC_ARM_NEON_mw_lib
Total Number of tables:	4

Expand the library on the left pane (tree view) to see all tables in this code replacement library, including those inherited from its base libraries.
Tables in this library, listed in prioritized order from high to low, are:
crl_table_ne10
dst_crl_table_ne10
dst_sysobj_crl_table_ne10
GCC_ARM_NEON_mw_lib

Display Contents of Code Replacement Table

```
crviewer(clr_table_ne10)
```



Name	Implen
abs	ne10_a
RTW_OP_ADD	ne10_a
RTW_OP_ADD	ne10_a
RTW_OP_ADD	ne10_a
RTW_OP_ELEM_MUL	ne10_n
RTW_OP_MINUS	ne10_s
RTW_OP_MINUS	ne10_r
RTW_OP_MINUS	ne10_s

Table

Summary

Description:	
Name:	Table
Version:	1.0
Number of entries:	8

Select entries in middle pane (list view) to see entry details in the right pane.

- "Choose a Code Replacement Library"

Programmatic Use

`crviewer(library)` opens the Code Replacement Viewer and displays the contents of `library`, where `library` is a string that names a registered code replacement library. For example, `'GNU 99 extensions'`.

`crviewer(table)` opens the Code Replacement Viewer and displays the contents of `table`, where `table` is a MATLAB file that defines code replacement tables. The file must be in the current folder or on the MATLAB path.

More About

- "What Is Code Replacement?"
- "Code Replacement Libraries"
- "Code Replacement Terminology"