Release Notes for MATLAB® Coder™

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Release Notes for MATLAB® Coder™

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R2012b

Version: 2.3
New Features: Yes
Bug Fixes: Yes

`parfor` function support for MEX code generation, enabling execution on multiple cores

You can use MATLAB® Coder™ software to generate MEX functions from MATLAB code that contains `parfor`-loops. The generated MEX functions can run on multiple cores on a desktop. For more information, see `parfor` and "Acceleration of MATLAB Algorithms Using Parallel for-loops (parfor)".

Code generation readiness tool

The code generation readiness tool screens MATLAB code for features and functions that are not supported for code generation. The tool provides a report that lists the source files that contain unsupported features and functions and an indication of how much work is needed to make the MATLAB code suitable for code generation.

For more information, see `coder.screener` and "Code Generation Readiness Tool".

Reduced data copies and lightweight run-time checks for generated MEX functions

MATLAB Coder now eliminates data copies for built-in, non-complex data types. It also performs faster bounds checks. These enhancements result in faster generated MEX functions.

Additional string function support for code generation

The following string functions are now supported for code generation. To view implementation details, see “Functions Supported for Code Generation — Alphabetical List”.

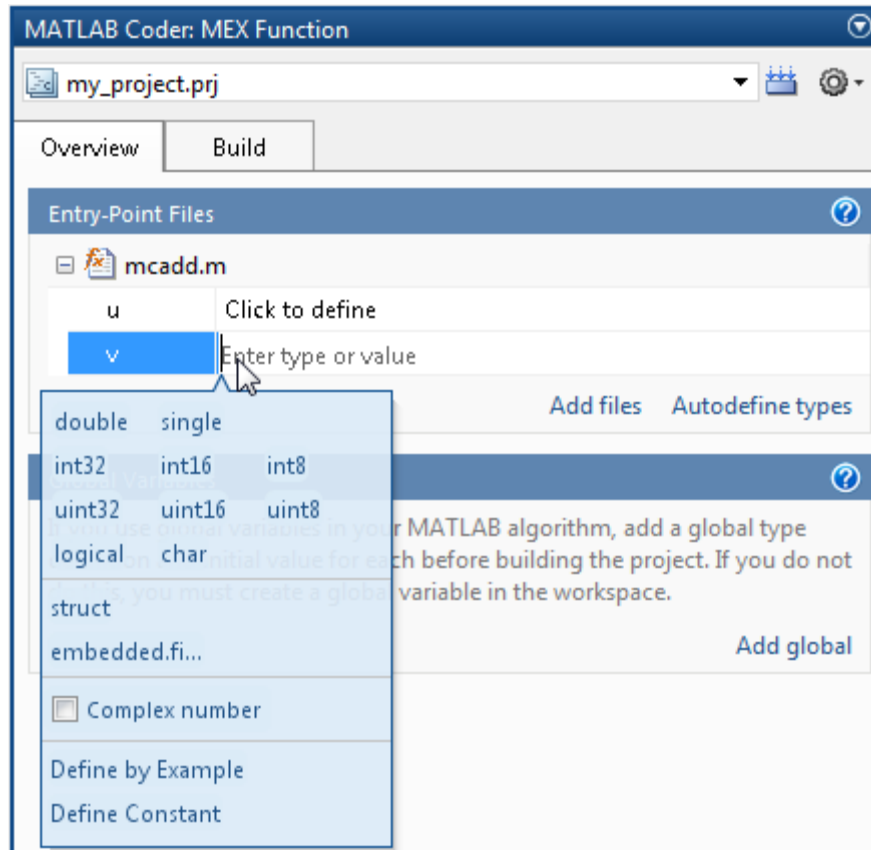
- `deblank`
- `hex2num`
- `isletter`
- `isspace`
- `isstrprop`
- `lower`
- `num2hex`
- `strcmpi`
- `strjust`
- `strncmp`
- `strncmpi`
- `strtok`
- `strtrim`
- `upper`

Visualization functions in generated MEX functions

The MATLAB Coder software now 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.

Input parameter type specification enhancements

The updated project user interface facilitates input parameter type specification.



Project import and export capability

You can now export project settings to a configuration object stored as a variable in the base workspace. You can then use the configuration object to import the settings into a different project or to generate code at the command line with the `codegen` function. This capability allows you to:

- Share settings between the project and command-line workflow
- Share settings between multiple projects
- Standardize on settings for code generation projects

For more information, see “Share Build Configuration Settings”.

Package generated code in zip file for relocation

The `packNGo` function packages generated code files into a compressed zip file so that you can relocate, unpack, and rebuild them in another development environment. This capability is useful if you want to relocate files so that you can recompile them for a specific target environment or rebuild them in a development environment in which MATLAB is not installed.

For more information, see “Package Code For Use in Another Development Environment”.

Fixed-point instrumentation and data type proposals

MATLAB Coder projects provide the following fixed-point conversion support:

- Option to generate instrumented MEX functions
- Use of instrumented MEX functions to provide simulation minimum and maximum results
- Fixed-point data type proposals based on simulation minimum and maximum values
- Option to propose fraction lengths or word lengths

You can use these proposed fixed-point data types to create a fixed-point version of your original MATLAB entry-point function.

Note Requires a Fixed-Point Toolbox™ license.

For more information, see “Fixed-Point Conversion”.

New toolbox functions supported for code generation

To view implementation details, see "Functions Supported for Code Generation — Alphabetical List".

Computer Vision System Toolbox

- `integralImage`

Image Processing Toolbox

- `bwlookup`
- `bwmorph`

Interpolation and Computational Geometry

- `interp2`

String Functions

- `deblank`
- `hex2num`
- `isletter`
- `isspace`
- `isstrprop`
- `lower`
- `num2hex`
- `strcmpi`
- `strjust`
- `strncmp`
- `strncmpi`
- `strtok`

- `strtrim`
- `upper`

Trigonometric Functions

- `atan2d`

New System objects supported for code generation

The following System objects are now supported for code generation. To see all System objects supported for code generation, see "System Objects Supported for Code Generation".

Communications System Toolbox

- `comm.ACPR`
- `comm.BCHDecoder`
- `comm.CCDF`
- `comm.CPMCarrierPhaseSynchronizer`
- `comm.GoldSequence`
- `comm.LDPCDecoder`
- `comm.LDPCEncoder`
- `comm.LTEMIMOChannel`
- `comm.MemorylessNonlinearity`
- `comm.MIMOChannel`
- `comm.PhaseNoise`
- `comm.PSKCarrierPhaseSynchronizer`
- `comm.RSDecoder`

DSP System Toolbox

- `dsp.AllpoleFilter`
- `dsp.CICDecimator`
- `dsp.CICInterpolator`
- `dsp.IIRFilter`
- `dsp.SignalSource`

Check bug reports for issues and fixes

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

Search R2012b Bug Reports

Known Bugs for Incorrect Code Generation:
`www.mathworks.com/support/bugreports/?product=ALL&release=R2012b&keyword=Incorrect+Code+Generation`

All Known Bugs for This Product:
`www.mathworks.com/support/bugreports/?release=R2012b&product=ME`

R2012a

Version: 2.2
New Features: Yes
Bug Fixes: No

Code Generation for MATLAB Classes

In R2012a, there is preliminary support for code generation for MATLAB classes targeted at supporting System objects defined by users. For more information about generating code for MATLAB classes, see Code Generation for MATLAB Classes. For more information about generating code for System objects, see the DSP System Toolbox™, Computer Vision System Toolbox™ or the Communications System Toolbox™ documentation.

Dynamic Memory Allocation Based on Size

Compatibility Considerations: Yes

By default, dynamic memory allocation is now enabled for variable-size arrays whose size exceeds a configurable threshold. This behavior allows for finer control over stack memory usage. Also, you can generate code automatically for more MATLAB algorithms without modifying the original MATLAB code.

Compatibility Considerations

If you use scripts to generate code and you do not want to use dynamic memory allocation, you must disable it. For more information, see Controlling Dynamic Memory Allocation.

C/C++ Dynamic Library Generation

You can now use MATLAB Coder to build a dynamically linked library (DLL) from the generated C code. These libraries are useful for integrating into existing software solutions that expect dynamically linked libraries.

For more information, see Generating C/C++ Dynamically Linked Libraries from MATLAB Code.

Automatic Definition of Input Parameter Types

MATLAB Coder software can now automatically define input parameter types by inferring these types from test files that you supply. This capability facilitates input type definition and reduces the risk of introducing errors when defining types manually.

To learn more about automatically defining types:

- In MATLAB Coder projects, see Autodefining Input Types.
- At the command line, see the `coder.getArgTypes` function reference pagehttp://www.mathworks.com/help/releases/R2012a/toolbox/coder/ref/coder.getargtyp

Verification of MEX Functions

MATLAB Coder now provides support for test files to verify the operation of generated MEX functions. This capability enables you to verify that the MEX function is functionally equivalent to your original MATLAB code and to check that no run-time errors occur.

To learn more about verifying MEX function behavior:

- In MATLAB Coder projects, see How to Verify MEX Functions in a Project.
- At the command line, see the `coder.runTest` function reference pagehttp://www.mathworks.com/help/releases/R2012a/toolbox/coder/ref/coder.runtest.h

Enhanced Project Settings Dialog Box

The **Project Settings** dialog box now groups configuration parameters so that you can easily identify the parameters associated with code generation objectives such as speed, memory, and code appearance. The dialog boxes for code generation configuration objects, `coder.MexCodeConfig`, `coder.CodeConfig`, and `coder.EmbeddedCodeConfig`, also use the same new groupings.

To view the updated **Project Settings** dialog box:

1. In a project, click the **Build** tab.
2. On the **Build** tab, click the More settings link to open the **Project Settings** dialog box.

   For information about the parameters on each tab, click the **Help** button.

To view the updated dialog boxes for the code generation configuration objects:

1. At the MATLAB command line, create a configuration object. For example, create a configuration object for MEX code generation.

   ```
   mex_cfg = coder.config;
   ```

2. Open the dialog box for this object.

   ```
   open mex_cfg
   ```

   For information about the parameters on each tab, click the **Help** button.

Projects Infer Input Types from assert Statements in Source Code

MATLAB Coder projects can now infer input data types from `assert` statements that define the properties of function inputs in your MATLAB entry-point files. For more information, see Defining Inputs Programmatically in the MATLAB File.

Code Generation from MATLAB

For details about new toolbox functions and System objects supported for code generation, see the Code Generation from MATLAB Release Notes.

New Demo

The following demo has been added:

Demo...	Shows How You Can...
`coderdemo_reverb`	Generate a MEX function for an algorithm that uses MATLAB classes.

Check bug reports for issues and fixes

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Search R2012a Bug Reports

Known Bugs for Incorrect Code Generation:
`www.mathworks.com/support/bugreports/?product=ALL&release=R2012a&keyword=Incorrect+Code+Generation`

All Known Bugs for This Product:
`www.mathworks.com/support/bugreports/?release=R2012a&product=ME`

R2011b

Version: 2.1
New Features: Yes
Bug Fixes: No

Support for Deletion of Rows and Columns from Matrices

You can now generate C/C++ code from MATLAB code that deletes rows or columns from matrices. For example, the following code deletes the second column of matrix `X`:

```
X(:,2) = [];
```

For more information, see Diminishing the Size of a Matrix in the MATLAB documentation.

Code Generation from MATLAB

For details of new toolbox functions and System objects supported for code generation, see Code Generation from MATLAB Release Notes.

Check bug reports for issues and fixes

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Search R2011b Bug Reports

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`www.mathworks.com/support/bugreports/?product=ALL&release=R2011b&keyword=Incorrect+Code+Generation`

All Known Bugs for This Product:
`www.mathworks.com/support/bugreports/?release=R2011b&product=ME`

R2011a

Version: 2.0
New Features: Yes
Bug Fixes: No

New User Interface for Managing Projects

The new MATLAB Coder user interface simplifies the MATLAB to C/C++ code generation process. Using this user interface, you can:

- Specify the MATLAB files from which you want to generate code
- Specify the data types for the inputs to these MATLAB files
- Select an output type:
  - MEX function
  - C/C++ Static Library
  - C/C++ Executable
- Configure build settings to customize your environment for code generation
- Open the code generation report to view build status, generated code, and compile-time information for the variables and expressions in your MATLAB code

To Get Started

You launch a MATLAB Coder project by doing one of the following:

- From the MATLAB main menu, select **File > New > Code Generation Project**
- Enter `coder` at the MATLAB command line

To learn more about working with MATLAB Coder, see Generating C Code from MATLAB Code Using the MATLAB Coder Project Interface.

Migrating from Real-Time Workshop emlc Function

Compatibility Considerations: Yes

In MATLAB Coder, the `codegen` function replaces `emlc` with the following differences:

New codegen Options

Old emlc Option	New codegen Option
`-eg`	`-args`
`emlcoder.egc`	`coder.Constant`
`emlcoder.egs`	`coder.typeof(a,b,1)` specifies a variable-size input with the same class and complexity as `a` and same size and upper bounds as the size vector `b`. Creates `coder.Type` objects for use with the `codegen -args` option. For more information, see `coder.typeof`.
`-F`	No `codegen` option available. Instead, use the default fimath. For more information, see the Fixed-Point Toolbox documentation.
`-global`	`-globals` **Note** `-global` continues to work with `codegen`
`-N`	This option is no longer supported. Instead, set up `numerictype` in MATLAB.
`-s`	`-config` Use with the new configuration objects, see "New Code Generation Configuration Objects" on page 34.

Old emlc Option	New codegen Option
`-T rtw:exe`	`-config:exe` Use this option to generate a C/C++ executable using default build options. Otherwise, use `-config` with a `coder.CodeConfig` or `coder.EmbeddedCodeConfig` configuration object.
`-T mex`	`-config:mex` Use this option to generate a MEX function using default build options. Otherwise, use `-config` with a `coder.MexCodeConfig` configuration object.
`-T rtw` `-T rtw:lib`	`-config:lib` Use either of these options to generate a C/C++ library using default build options. Otherwise, use `-config` with a `coder.CodeConfig` or `coder.EmbeddedCodeConfig` configuration object.

New Code Generation Configuration Objects

The `codegen` function uses new configuration objects that replace the old `emlc` objects with the following differences:

Old emlc Configuration Object	New codegen Configuration Object
`emlcoder.MEXConfig`	`coder.MexCodeConfig`
`emlcoder.RTWConfig` `emlcoder.RTWConfig('grt')`	`coder.CodeConfig` The `SupportNonFinite` property is now available without an Embedded Coder® license. The following property names have changed: • `RTWCompilerOptimization` is now `CCompilerOptimization`

Old emlc Configuration Object	New codegen Configuration Object
	• `RTWCustomCompilerOptimization` is now `CCustomCompilerOptimization` • `RTWVerbose` is now `Verbose`
`emlcoder.RTWConfig('ert')`	`coder.EmbeddedCodeConfig` The following property names have changed: • `MultiInstanceERTCode` is now `MultiInstanceCode` • `RTWCompilerOptimization` is now `CCompilerOptimization` • `RTWCustomCompilerOptimization` is now `CCustomCompilerOptimization` • `RTWVerbose` is now `Verbose`
`emlcoder.HardwareImplementation`	`coder.HardwareImplementation`

The codegen Function Has No Default Primary Function Input Type

In previous releases, if you used the `emlc` function to generate code for a MATLAB function with input parameters, and you did not specify the types of these inputs, by default, `emlc` assumed that these inputs were real, scalar, doubles. In R2011a, the `codegen` function does not assume a default type. You must specify at least the class of each primary function input. For more information, see Specifying Properties of Primary Function Inputs in a Project.

Compatibility Considerations

If your existing script calls `emlc` to generate code for a MATLAB function that has inputs and does not specify the input types, and you migrate this script to use `codegen`, you must modify the script to specify inputs.

The codegen Function Processes Compilation Options in a Different Order

In previous releases, the `emlc` function resolved compilation options from left to right so that the right-most option prevailed. In R2011a, the `codegen` function gives precedence to individual command-line options over options specified using a configuration object. If command-line options conflict, the right-most option prevails.

Compatibility Considerations

If your existing script calls `emlc` specifying a configuration object as well as other command-line options, and you migrate this script to use `codegen`, `codegen` might not use the same configuration parameter values as `emlc`.

New coder.Type Classes

MATLAB Coder includes the following new classes to specify input parameter definitions:

- `coder.ArrayType`
- `coder.Constant`
- `coder.EnumType`
- `coder.FiType`
- `coder.PrimitiveType`
- `coder.StructType`
- `coder.Type`

New coder Package Functions

The following new package functions let you work with objects and types for C/C++ code generation:

Function	Purpose
`coder.config`	Create MATLAB Coder code generation configuration objects
`coder.newtype`	Create a new `coder.Type` object
`coder.resize`	Resize a `coder.Type` object
`coder.typeof`	Convert a MATLAB value into its canonical type

Script to Upgrade MATLAB Code to Use MATLAB Coder Syntax

The `coder.upgrade` script helps you upgrade to MATLAB Coder by searching your MATLAB code for old commands and options and replacing them with their new equivalents. For more information, at the MATLAB command prompt, enter `help coder.upgrade`.

Embedded MATLAB Now Called Code Generation from MATLAB

MathWorks® is no longer using the term *Embedded MATLAB* to refer to the language subset that supports code generation from MATLAB algorithms. This nomenclature incorrectly implies that the generated code is used in embedded systems only. The new term is *code generation from MATLAB*. This terminology better reflects the full extent of the capability for translating MATLAB algorithms into readable, efficient, and compact MEX and C/C++ code for deployment to both desktop and embedded systems.

MATLAB Coder Uses rtwTargetInfo.m to Register Target Function Libraries

In previous releases, the `emlc` function also recognized the customization file, `sl_customization.m`. In R2011a, the MATLAB Coder software does not recognize this customization file, you must use `rtwTargetInfo.m` to register a Target Function Library (TFL). To register a TFL, you must have Embedded Coder software. For more information, see Use the rtwTargetInfo API to Register a CRL with MATLAB Coder Software in the Embedded Coder documentation.

New Getting Started Tutorial Video

To learn how to generate C code from MATLAB code, see the “Generating C Code from MATLAB Code” video in the MATLAB Coder Getting Started demos.

New Demos

The following demos have been added:

Demo...	Shows How You Can...
Hello World	Generate and run a MEX function from a simple MATLAB program
Working with Persistent Variables	Compute the average for a set of values by using persistent variables
Working with Structure Arrays	Shows how to build a scalar template before growing it into a structure array, a requirement for code generation from MATLAB.
Balls Simulation	Simulates bouncing balls and shows that you should specify only the entry function when you compile the application into a MEX function.
General Relativity with MATLAB Coder	Uses Einstein's theory of general relativity to calculate geodesics in curved space-time.
Averaging Filter	Generate a standalone C library from MATLAB code using `codegen`
Edge Detection on Images	Generate a standalone C library from MATLAB code that implements a Sobel filter
Read Text File	Generate a standalone C library from MATLAB code that uses the `coder.ceval`, `coder.extrinsic` and `coder.opaque` functions.
"Atoms" Simulation	Generate a standalone C library and executable from MATLAB code using a code generation configuration object to enable dynamic memory allocation

Demo...	Shows How You Can...
Replacing Math Functions and Operators	Use target function libraries (TFLs) to replace operators and functions in the generated code **Note** To run this demo, you need Embedded Coder software.
Kalman Filter	• Generate a standalone C library from a MATLAB version of a Kalman filter • Accelerate the Kalman filter algorithm by generating a MEX function

Functionality Being Removed in a Future Version

Compatibility Considerations: Yes

This function will be removed in a future version of MATLAB Coder software.

Function Name	What Happens When You Use This Function?	Compatibility Considerations
`emlc`	Still runs in R2011a	None

Function Elements Being Removed in a Future Release

Compatibility Considerations: Yes

Function or Element Name	What Happens When You Use the Function or Element?	Use This Element Instead
`%#eml`	Still runs	`%#codegen`
`eml.allowpcode`	Still runs	`coder.allowpcode`
`eml.ceval`	Still runs	`coder.ceval`
`eml.cstructname`	Still runs	`coder.cstructname`
`eml.extrinsic`	Still runs	`coder.extrinsic`
`eml.inline`	Still runs	`coder.inline`
`eml.nullcopy`	Still runs	`coder.nullcopy`
`eml.opaque`	Still runs	`coder.opaque`
`eml.ref`	Still runs	`coder.ref`
`eml.rref`	Still runs	`coder.rref`
`eml.target`	Still runs	`coder.target`
`eml.unroll`	Still runs	`coder.unroll`
`eml.varsize`	Still runs	`coder.varsize`
`eml.wref`	Still runs	`coder.wref`

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All Known Bugs for This Product:
`www.mathworks.com/support/bugreports/?release=R2011a&product=ME`