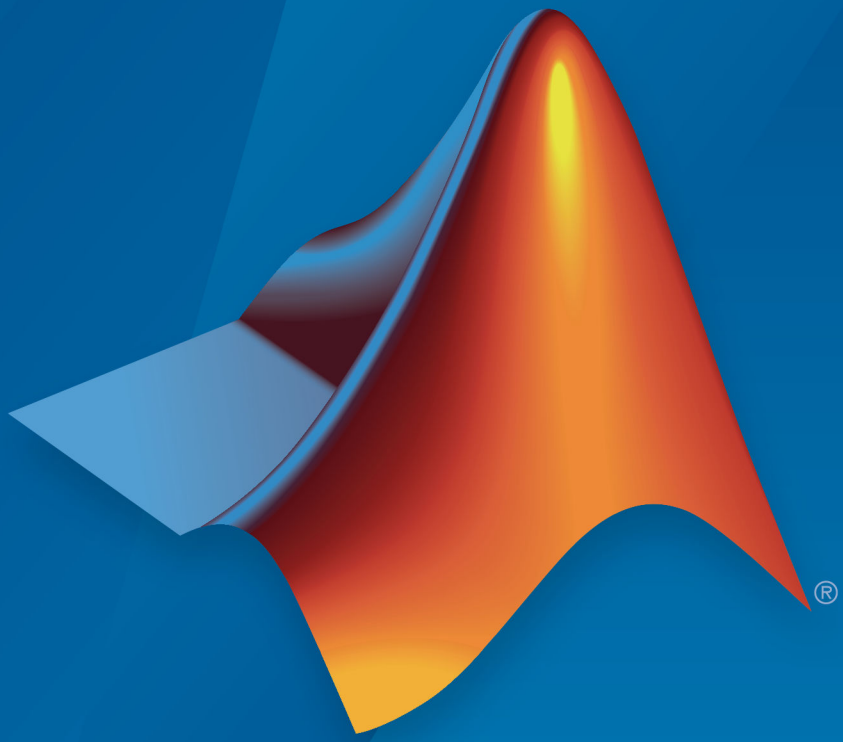
Simulink® Test™ Release Notes



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Simulink® Test™ Release Notes

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Version: 3.0

New Features

Bug Fixes

Temporal Requirements Verification: Assess model timing and signal behavior using a form-based editor

Hybrid systems with discrete- and continuous-time behavior can require complex timing-dependent signal logic. To verify this logic, you can create temporal assessments using the new **Logical and Temporal Assessments** editor in the Test Manager.

The editor helps you translate your textual requirements into unambiguous assessments with clear, well-defined semantics. To create a temporal assessment, you use a form-based editor that prompts you for particular conditions, events, signal values, delays, and responses that make up the assessment. For increased readability, the editor summarizes the assessment in a language-like statement.

To help with debugging, results include graphical representations of both the desired behavior and the actual output. You can expand statements to view plots of each signal that contributes to the overall result. For more information, see “Assess Temporal Logic Using Temporal Assessments”.

Observers: Wirelessly access signals and add verification logic without side effects

Observers allow you to monitor the dynamic response of your system model without signal lines. You can wirelessly debug and test Simulink signals from multiple areas and hierarchies of your system.

To use Observers, you add an Observer Reference block to your system model. The Observer Reference block houses a separate Simulink model: the Observer model. The Observer model contains Observer Ports, which are mapped to signals from your system model.

Accessing data by using Observers keeps your model block diagram simple. You do not need to add ports, blocks, connections, or interfaces to your model. Observer blocks preserve your model simulation semantics, which can help increase confidence that your verification results apply to the implemented system. For more information, see “Access Model Data Wirelessly by Using Observers”.

Simulation Output: Select signals and log data using a revised interface

R2019a introduces a revised interface and additional capabilities for capturing signal data:

- When you select signals in your model, you can now navigate through the model hierarchy and add signals as you go.
- The signal selection dialog displays new signals to add and also displays signals you have already selected.
- You can now capture data from local and global data stores, and select signals inside referenced models.

To capture signal data in a test case:

1. Expand the **Simulation Outputs** section of the test case.
2. Highlight blocks or signals in the system under test.
3. Select signals of interest to add to your test case.

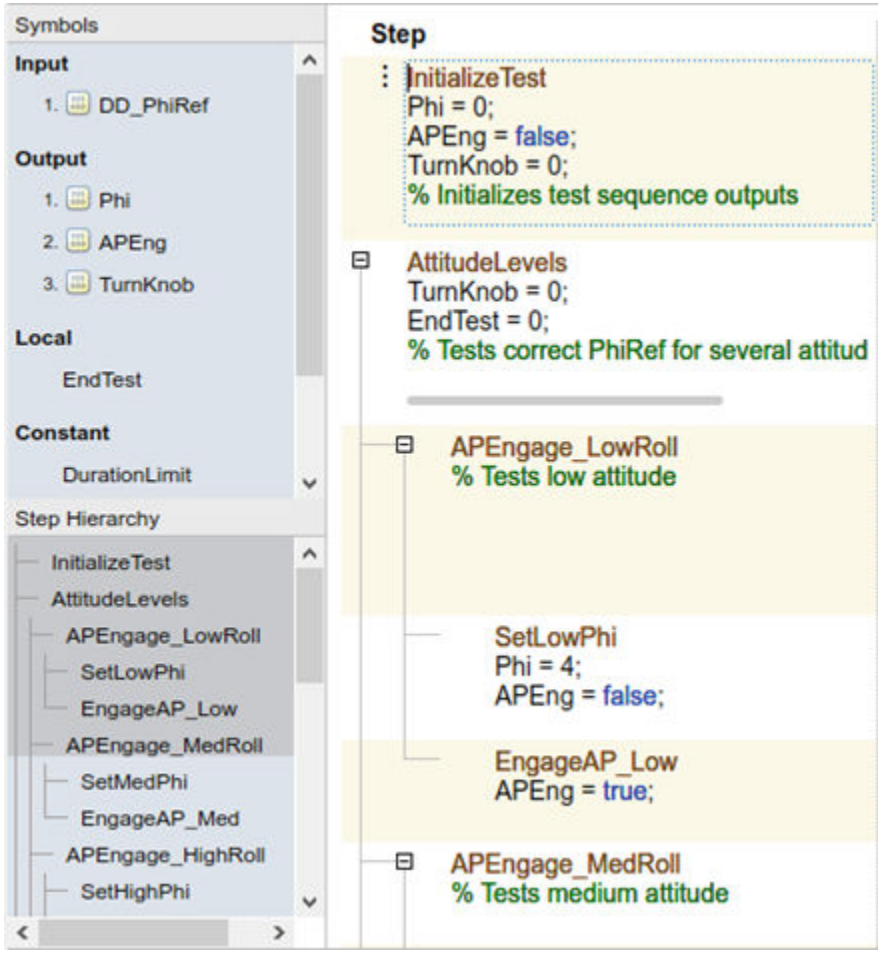
For more information, see “Capture Simulation Data in a Test Case”.

Input Data and Iterations: Test and iterate using Signal Editor scenarios

The Signal Editor block allows you to author multiple input data scenarios in a model or test harness. You can now select a Signal Editor scenario as a test case input. You can also run test case iterations that use different scenarios from the Signal Editor block. For more information on selecting inputs and creating iterations, see “Inputs” and “Test Iterations”.

Test Sequence Summary: Navigate test sequence steps using a summary view

You can scroll through test steps by using the **Step Hierarchy** pane in the Test Sequence Editor. For long and complex test sequences, the hierarchy pane gives you a high-level summary of the sequence using the test step names only. The pane highlights the test steps that are visible in the editor. You can scroll through the hierarchy and click in the pane to navigate to a new group of test steps in the editor.



Test Sequence Search: Find text in a test sequence

You can find and replace text in Test Sequence actions, transitions, and descriptions by using the **Find & Replace** tool in the Test Sequence Editor toolbar. To open the **Find & Replace** tool, click the  icon in the toolbar.

1 In the **Find what:** box, enter the text you want to locate.

2 In the **Replace with:** with box, enter the updated text.

3 To locate the text, click **Find Next** or **Find Previous**.

4 Click **Replace** to replace the old text with the updated text.

Test Coverage: Justify or exclude model objects using a coverage filter

When using Simulink Coverage™ to record test coverage, you can exclude or justify model objects that are intentionally not exercised. Specify a coverage filter file in the Test Manager, for a test file, test suite, or test case. For information on setting the coverage filter from the Test Manager, see “Measure Model Coverage”. For information on setting the coverage filter programmatically, see `sltest.testmanager.CoverageSettings`. For more information on how to use coverage filters, see “Coverage Filtering” (Simulink Coverage).

Baseline Testing: Store baseline data in MLDATX format

In R2019a, you can add signal data from MLDATX files as baseline data, and use MLDATX files to capture baseline data from a simulation. Additional model elements are supported for baseline data capture:

- Arrays of buses
- Simscape™ data
- For Each Subsystem data

Testing with MATLAB Unit Test

You can create an MLDATX results file when you run a Simulink Test test file using MATLAB® Unit Test. By creating an MLDATX results file, you can view and investigate results in the Test Manager.

1 Create the `sltest.plugins.TestManagerResultsPlugin` using the `'ExportToFile'` name-value pair. Specify a name for the MLDATX file.

2 To view results in the Test Manager, click the **Import** button in the Test Manager toolbar and select the MLDATX file.

Simulink Test contextual tab in the Simulink toolstrip

In R2019a, you have the option to turn on the Simulink Toolstrip. See “Simulink Toolstrip Tech Preview replaces menus and toolbars in the Simulink Desktop” (Simulink) in the Simulink release notes for more details.

The Simulink Toolstrip includes contextual tabs –– they appear only when you need them. The Simulink Test contextual tabs include options for completing actions that apply only to Simulink Test.

- To enable the Simulink Test toolstrip, from the Simulink toolstrip, click **Apps** then click the **Simulink Test** button. The **Test** tab appears.
- Options in the **Test** tab change depending on what you select in the Simulink Editor. For example, you can create a test harness for a subsystem by selecting the subsystem, then clicking the **Add Test Harness for Selection** button.

Test harness support for bus element ports

In Simulink, you can use bus element ports to access individual bus signals at model interfaces. In Simulink Test, you can create a test harness for a Model block or a model block diagram that uses bus element ports at its root level. Creating a test harness and selecting test harness properties follows the process described in “Create Test Harnesses and Select Properties”.

R2018b

Version: 2.5

New Features

Bug Fixes

Compatibility Considerations

Excel-Based Testing: Define test cases in Excel spreadsheets

In R2018b, you can use Excel® to specify test case input data, output data, tolerances, and parameters. You can also capture simulation output in the same file.

If you have existing test data, you can generate an Excel template from your model, then copy the data to the template. For details, see Author a Test in Excel. Once your Excel data is complete, you can create test from the Excel file. For details, see Create Test with Data from Excel.

C Caller Block Support: Test models that contain handwritten code

The C Caller block allows you to call a C function directly from a model. You can test the C function by creating a test harness for the C Caller block. Highlight the block and select **Analysis > Test Harness > Create for** *[block name]*. For details, see Test Integrated Code. For an example, see C Code Verification with Simulink Test.

SystemVerilog Assertions: Map Test Assessment blocks to SystemVerilog Assertions in generated DPI components

DPI component generation for HDL Verifier™ is now supported for `verify` statements in Test Sequence blocks and Test Assessment blocks. After adding `verify` statements to the block, you can generate a SystemVerilog DPI component that includes a verification to be used in a Verilog® or SystemVerilog simulation. For more information, see Generate SystemVerilog DPI Component from `verify` Statement (HDL Verifier).

Unified Scheduling Options: Generate scheduler for modeling styles including export function models and rate-based models

You can use scheduler blocks to execute functions and function-call subsystems in your test harness. When you include a scheduler in a test harness, the scheduler interface is consistent for different modeling styles, including export function models, rate-based models, and models with asynchronous function calls (JMAAB style B). Also, you can select a Test Sequence block or MATLAB Function block as the scheduler. In previous releases, you could use a Test Sequence block only.

If your model or subsystem has function calls or root inports, the test harness includes the scheduler block.

To include a scheduler in the test harness:

1. From the Simulink menu, select **Analysis > Test Harness > Create for Model**. For a subsystem test harness, select the subsystem and select **Analysis > Test Harness > Create for** *[block name]*.
2. In the test harness create dialog box, for **Add scheduler for function-calls and rates**, select `Test Sequence` or `MATLAB Function` from the list. To include no scheduler block and connect function calls to Inport blocks, select `None`.
3. To include calls to initialize, reset, and terminate functions in your model, in the test harness create dialog box, select **Enable initialize, reset, and terminate ports**.

When creating test harnesses with `sltest.harness.create`, use the new option `'SchedulerBlock'`.

Test harness support for string data types

When you create a test harness, a string input is connected to an Inport, Ground, or String Constant block, depending on which harness source you choose. A string output is connected to an Outport or Terminator block, depending on the harness sink you choose. For a list of source and sink blocks that get connected to string inputs and outputs, see **Test Harness Construction for Specific Model Elements**.

Testing with MATLAB Unit Test

- You can specify the location to save the HTML model coverage report. Construct a `ModelCoverageReport` object that specifies the folder. Use the `ModelCoverageReport` object when you create the `ModelCoveragePlugin`. For more information, see the example on the `ModelCoverageReport` reference page.
- You can get model coverage results in a format compatible with continuous integration systems such as Jenkins™. Use the `ModelCoveragePlugin`, `ModelCoverageReport`, and `CoberturaFormat`. For more information, see Tests for Continuous Integration.
- You can include Test Manager results in the **Details** field of each `TestResult` object by using the `TestManagerResultsPlugin`. To publish Test Manager results in the MATLAB Test Report, configure your test file for reporting and add the `TestReportPlugin` and `TestManagerResultsPlugin` classes to the `TestRunner`

object. For more information, see the example on the `TestManagerResultsPlugin` reference page.

Ability to overwrite simulation output results

When you run the same test multiple times, by default simulation output signals are added to existing plots. To instead overwrite the results with the newest data, in the test results, right-click **Sim Output** and select **Plot Signals > Overwrite**. For more information, see Simulation Outputs.

Functionality being removed or changed

`DriveFcnCallWithTestSequence` in `sltest.harness.create` is not recommended
Still runs

When you use `sltest.harness.create`, using `DriveFcnCallWithTestSequence` to include a scheduler block is not recommended. Use the new name-value pair `'SchedulerBlock','Test Sequence'`.

R2018a

Coverage Aggregation: Merge coverage results from multiple test runs

You can merge code coverage results from different test runs to a new set of results. In previous releases, only multiple test cases from the same test file showed all the results in the **Aggregated Coverage Results** section. In R2018a, you can merge results from multiple test files.

In the Test Manager **Results and Artifacts** pane, select the results sets whose coverage results you want to show together. From the context menu, select **Merge Coverage Results**. The merged results appear in the list, and the combined coverage results appear under **Aggregated Coverage Results**. For more information, see Collect Coverage in Tests.

Input Data Templates: Generate Excel and MAT-file templates for signal data from models

You can create Microsoft® Excel and MAT-file templates for input data from your Simulink model. After you create a template, fill it in with your test data. You can then use the resulting file as input to a baseline test.

To create the template, in a baseline test case for a model, under **Inputs**, click **Create**. Use the dialog box to specify whether to create a MAT-file or Excel file and the location. Then click **Create**.

For more information, see Create Data Files to Use as Test Inputs.

Excel Format for Baseline Tests: Capture baseline simulation data in Excel files

You can now capture baseline simulation data to a Microsoft Excel file. Previously, you captured baseline data only to MAT-files.

In a baseline test case, under **Baseline Criteria**, click **Capture**. Select **Excel** as the file format, and then click **Capture**.

For more information on capturing baselines, see Capture Baseline Criteria.

Excel Format Changes: Save test inputs and outputs in same sheet

You can now save Test Manager inputs and outputs in the same sheet. When you capture your baseline or create an input file, by default you save them to the same sheet and file. Also, when you create an Excel for inputs and outputs, you can enter all of the information in the same file. For details on the format, see Specify Microsoft Excel File Format for Signal Data.

Signal Editor: Create test scenario input data using a Signal Editor block source

With the Signal Editor block, you can create test input data scenarios and switch between them during simulation. Select the Signal Editor block source during test harness creation. For more information on the Signal Editor block, see Create and Edit Signal Data.

Coverage Metrics: Function and function-call metrics reported in Test Manager

Test Manager now reports on function and function-call coverage metrics. You can select these metrics in the **Coverage Settings** section of your test case to include the function and function-call coverage percentage in your test results.

For more information on selecting code coverage options in Test Manager, see Collect Coverage in Tests. For more information on coverage metrics, see Types of Model Coverage.

Changes to Test Sequence block programmatic interface

The Test Sequence Block programmatic interface has the following changes:

- The block property `EnableActiveStepOutput` is renamed to `EnableActiveStepData`. This property is used in `sltest.testsequence.getProperty` and `sltest.testsequence.setProperty`.
- The block property `OutputData` is renamed to `ActiveStepDataSymbol`. This property is used in `sltest.testsequence.getProperty` and `sltest.testsequence.setProperty`.

Compatibility Considerations

- For scripts using the `EnableActiveStepOutput` property in `sltest.testsequence.getProperty`, update scripts to use `EnableActiveStepData`:

  ```
  blockInfo = sltest.testsequence.getProperty(blockPath,'EnableActiveStepData')
  ```

- For scripts using the `EnableActiveStepOutput` property in `sltest.testsequence.setProperty`, update scripts to use `EnableActiveStepData`:

  ```
  blockInfo = sltest.testsequence.setProperty(blockPath,'EnableActiveStepData',Value)
  ```

- For scripts using the `OutputData` property in `sltest.testsequence.getProperty`, update scripts to use `ActiveStepDataSymbol`:

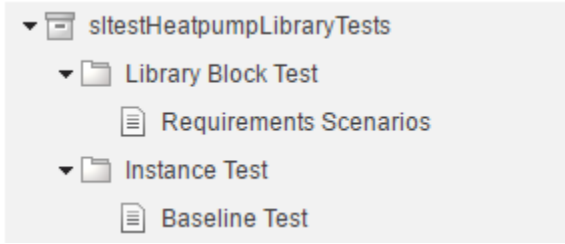
  ```
  blockInfo = sltest.testsequence.getProperty(blockPath,'ActiveStepDataSymbol')
  ```

- For scripts using the `OutputData` property in `sltest.testsequence.setProperty`, update scripts to use `ActiveStepDataSymbol`:

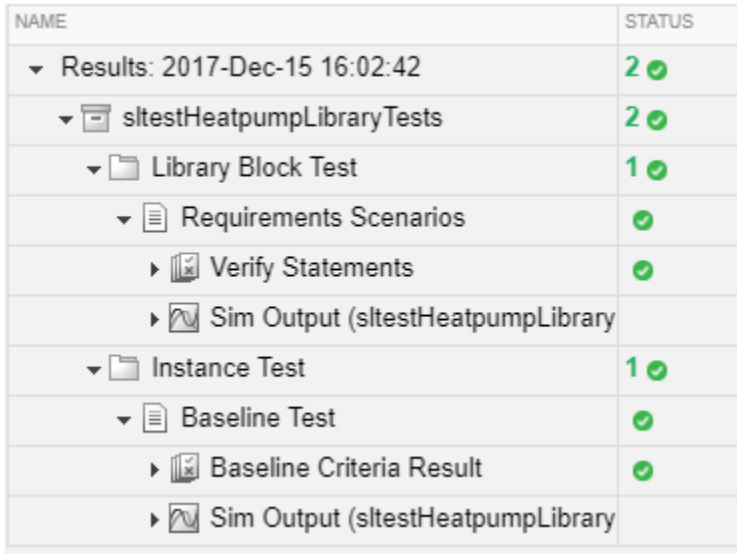
  ```
  blockInfo = sltest.testsequence.setProperty(blockPath,'ActiveStepDataSymbol',Value)
  ```

Testing with MATLAB Unit Test

- Model coverage: You can collect model coverage when running test cases using MATLAB Unit Test. Create a model coverage plugin for the test runner, attach the plugin to the test runner, then run the test. For more information and an example, see `sltest.plugins.ModelCoveragePlugin`.
- Results hierarchy with MATLAB Unit Test: When you run Simulink Test test files using MATLAB Unit Test, the Test Manager results now reflect the test hierarchy. Previously, the results appeared in a flat list. For example, this test file contains two test suites:



Running the test with MATLAB Unit Test produces Test Manager results with hierarchy:



In the command-line results, the result `Name` field reflects the hierarchy. For example, running the test file produces:

```
heatpumpResult =

  1×2 TestResult array with properties:

    Name
    Passed
    Failed
    Incomplete
    Duration
    Details

Totals:
   2 Passed, 0 Failed, 0 Incomplete.
   4.4774 seconds testing time.
```

The result `Name` field lists test file, test suite, and test case names:

```
>> heatpumpResult.Name

ans =

    'sltestHeatpumpLibraryTests > Library Block Test/Requirements Scenarios'


ans =

    'sltestHeatpumpLibraryTests > Instance Test/Baseline Test'
```

R2017b

Test Harness Generation Callbacks: Customize harness creation with post-create and post-rebuild callbacks

Customize test harnesses using callback functions that run after you create or rebuild the test harness. For example, you can add custom source or sink blocks, add a plant model for closed-loop testing of a controller, or enable data logging. Test harness callbacks are reusable functions, allowing you to add or change harness features and settings systematically. To create a callback:

1. Create the callback function. In the function, script the commands to customize the test harness.
2. Specify the function as the **Post-create callback method** or **Post-rebuild callback** method. For a new test harness, specify a post-create or post-rebuild callback in the **Advanced Properties** of the test harness creation dialog box. For an existing test harness, specify a post-rebuild callback in the harness properties dialog box.

For more information and an example, see Customize Test Harnesses.

Harness Component Synchronization Comparison: Identify differences in the component under test before explicitly synchronizing harnesses

Before synchronizing the component under test between the test harness and main model, you can check whether the component under test differs from the component in the main model by using sltest.harness.check. For more information on component synchronization, see Synchronize Changes Between Test Harness and Model.

Multirelease Testing: Execute test cases with older MATLAB releases

You can develop baseline, equivalence, and simulation tests in the current MATLAB release and run the test simulations in a different release. Developing tests in the current MATLAB release allows you to take advantage of recent Test Manager developments and run simulations in your production environment. The release you run the test in must support the features used in the test—for example, test harnesses—to run.

For baseline tests, you can establish the baseline data in one release and run the test case in that release. Or you can establish the baseline data in one release and run the test in another release, enabling you to compare results from different releases.

When running tests in multiple releases, your model or test harness must be compatible with the MATLAB version running your test. Also, the MATLAB version must support the features of your test case. Previous MATLAB versions do not support test case features unavailable in that release. Certain test case features are not supported for multiple release testing.

For more information, see Run Tests in Multiple Releases.

Signal Failure Navigation and Baseline Updates: Navigate between signal comparison failure regions, and automatically update baseline data

If a baseline test result includes failures, you can navigate between signal comparison failures in the data inspector view of the Test Manager. From this view, you can update the test baseline data in MAT-files. Updating the baseline data based on test failures is useful if your failures are due to a recent model update, such as a parameter value change.

For more information, see Examine Test Failures and Modify Baselines.

Expanded Microsoft Excel Support: Define test inputs and expected outputs including bus support and data type definition

Microsoft Excel files in Test Manager can now specify detailed information about signal data. You can use the expanded format for input signal data when you select an Excel file as baseline criteria.

In previous releases, in Excel file format only scalar doubles were supported. Now you can specify signal types (such as complex and multidimensional), data types, units, interpolation, bus element information, and function-call execution times. To learn about the format, see Specify Microsoft Excel File Format for Signal Data.

You can import multiple Microsoft Excel sheets at once to use as separate test input groups or a range of data to import. You can also specify sheets and a range of cells to use as baseline criteria.

The Test Manager API has some changes in support of the new capabilities.

- A new method, `addExcelSpecification`, for the `sltest.testmanager.BaselineCriteria` and `sltest.testmanager.TestInput` classes
- New arguments for specifying options for `sltest.testmanager.TestInput` files with `sltest.testmanager.TestCase.addBaselineCriteria` and `sltest.testmanager.TestCase.addInput`.
- A new property, `ExcelSpecifications`, for the `sltest.testmanager.BaselineCriteria` and `sltest.testmanager.TestInput` classes.

Compatibility Considerations

The `refreshIfExists` argument for `sltest.testmanager.TestCase.addBaselineCriteria` has been replaced with a Name,Value pair. Scripts that add MAT-files that use this argument will still work. See “Functionality Being Removed or Changed” on page 4-6 for details.

The `SheetName` property for `sltest.testmanager.TestInput` has been replaced with the `ExcelSpecifications` property. Scripts that use this property will still work. See “Functionality Being Removed or Changed” on page 4-6 for details.

The `sltest.testmanager.TestCase.addInput` method by default now returns one `sltest.testmanager.TestInput` object for each sheet in an Excel file added as a test case input. In previous releases, this method returned a single `sltest.testmanager.TestInput` object even if the Excel file had multiple sheets.

As a result, commands in existing scripts that operate on the result of this method might return an error. An error occurs with commands that expect a single object. Modify any such script to operate on an array instead. Or, to return a single option as in earlier releases, set the `'SeparateInputs'` option to `false`.

Test File Comparison: Identify differences by comparing two test files

You can review test changes or updates by comparing two test files side by side. Test file comparison is similar to comparisons of other MATLAB files that you compare using **Compare** on the MATLAB toolstrip.

For more information, see Compare Test Files.

Test Sequence Editor enhancements: Change step hierarchy, reorder transitions, and cut/copy/paste test steps

Create and edit test sequences with the enhanced Test Sequence Editor. For detailed information, see Test Sequence Editor.

- Change the hierarchy level of a test step by indenting or outdenting the test step. Right-click the test step, and select **Indent** to move it to a lower level, or **Outdent** to move it to a higher level.
- Reorder test steps. When hovering over a step, three dots appear left of the step name. Click and drag the dots to move the step to a new position within the same hierarchy level.
- Reorder test step transitions. Hover over the transition number, then click and drag the transition to the new order. The corresponding next step is maintained.
- Cut, copy, and paste test steps using the right-click context menu. You can paste before or after a step, or paste as a substep.

Input and Baseline Signal Editing: Edit test case baseline and input signal data

In R2017b, you can edit input signal data and expected outputs (baseline criteria) from MAT-files and Microsoft Excel in the Test Manager. In previous releases, you edited only Excel input files in the Test Manager.

You edit MAT-file data in the signal editor and Microsoft Excel data directly in Excel. For more information on editing the baseline signal data, see Manually Update Signal Data in a Baseline. For more information on editing input signals, see Edit Input Data Files in Test Manager.

Iteration Naming: Create rules to name autogenerated iterations

When auto generating iterations for a test case, you can customize iteration names by specifying a naming pattern. For more information, see Create Table Iterations.

External Inputs for Real-Time Applications: In test cases for real-time applications, map external data inputs to root Inport blocks

You can use external data mapped to root Inport blocks in real-time tests. This facilitates reusing desktop test cases in real-time testing, as both desktop and real-time tests can access the same test input data stored in an external file.

In your test harness or model, use root Inport blocks as sources. In the test case Inputs, map external data to the root Inport blocks using Microsoft Excel or MAT-files. For an example of reusing a desktop test case using input data in an Excel file, see Reuse Desktop Test Cases for Real-Time Testing.

Test Harness .MDL Support: Create test harnesses for models saved in .MDL file formats

Test harnesses support models that use the .MDL file format. Test harnesses for .MDL models are saved externally. For more information about externally vs. internally saved test harnesses, see Manage Test Harnesses.

Functionality Being Removed or Changed

The Test Manager API has these changes.

Functionality	Result	Use Instead	Compatibility Considerations
`refreshIfExists` argument in `sltest.testmanager.TestCase.addBaselineCriteria`	Still runs for MAT-files	`'RefreshIfExists',Boolean`	
`SheetName` property for `sltest.testmanager.TestInput`	Still runs	`ExcelSpecifications`	`SheetName` is now read-only

Functionality	Result	Use Instead	Compatibility Considerations
`sltest.testmanager.TestCase.addInput`	Now returns an array with Excel files if the file had multiple sheets	Use `'SeparateInputs',false` with existing scripts	Use `'SeparateInputs',false` only to match functionality from previous releases. The default of `true` matches the behavior in the interface.

R2017a

Harness Import: Simplify test harness management by converting test harness models to Simulink Test harnesses

To simplify management and synchronization of standalone harness models, such as those created manually, using Simulink Verification and Validation™, or Simulink Design Verifier™, convert the standalone models to test harnesses in Simulink Test. Converting standalone models to test harnesses allows you to iterate on your design using push and rebuild functions, and manage test harnesses using the UI and programmatic interface.

For more information, see Create Test Harnesses from Standalone Models and the function `sltest.harness.import`.

Expanded Test Harness Capabilities: Create test harnesses with additional semantics, blocks, sources, and synchronization behavior

1. Control when the component under test design synchronizes between the model and harness. When creating a test harness, select the harness **Synchronization Mode** in the **Advanced Properties**. For an existing harness, click the harness properties badge to change the synchronization mode. For more information, see Synchronize Changes Between Test Harness and Model. Synchronization modes include:

   - `Synchronize on harness open and close`: The component in the main model, or the test harness, is automatically updated when the harness closes or opens.
   - `Synchronize on harness open`: The component in the test harness is updated when the harness opens.
   - `Synchronize only during push and rebuild`: Synchronization does not occur when the harness opens or closes. You manually control synchronization by selecting **Analysis > Test Harness > Push Component and Parameters to Main Model** or **Analysis > Test Harness > Rebuild Harness from Main Model**.

2. Use Signal Builder blocks as sources for test inputs generated by Simulink Design Verifier analysis. `Signal Builder` is a **Harness Source** option when you select **Export test cases to Simulink Test** in the Simulink Design Verifier results dialog box. For more information, see Test Models Using Inputs Generated by Simulink Design Verifier™ .

3. Test user-defined functions by creating test harnesses for the following additional blocks in the User-Defined Functions library:
   - S-Function block
   - S-Function Builder block
   - Level-2 MATLAB S-Function block
4. Create test harnesses for subsystems within linked library blocks.
5. Move and clone test harnesses across different blocks in the same model or in different models. See Move and Clone Test Harnesses and the functions `sltest.harness.move` and `sltest.harness.clone`.
6. Create test harnesses for models that use a mix of asynchronous and rate-based modeling.
7. Create test harnesses that honor the sorted execution order of blocks and subsystems for export function modeling.

Compatibility Considerations

For `sltest.harness.create` and `sltest.harness.set`, the `'EnableComponentEditing'` option is removed. Editing the component under test is controlled by the CUT synchronization mode. Update scripts that use the `'EnableComponentEditing'` option to specify `'SynchronizationMode'`.

- To prevent editing the component under test in the test harness (previously specified by `'EnableComponentEditing',false`), use `'SynchronizationMode','SyncOnOpen'`.
- To allow editing the component under test in the test harness (previously specified by `'EnableComponentEditing',true`), use `'SynchronizationMode','SyncOnOpenAndClose'` (default) or `'SynchronizationMode','SyncOnPushRebuildOnly'`.

Support for Debug Mode: Debug system under test simulation

From the Test Manager, you can debug the system under test simulation. Click the **Debug** button in the Test Manager toolstrip before executing the test. The simulation pauses at simulation start and presents a debug prompt at the command line. You can step through simulation using the Stepping Options buttons in the Simulink Editor toolstrip. For more information, see Use Simulation Stepper (Simulink).

Time Tolerance: Specify leading and lagging time tolerance in test cases

Account for temporal shifts in your test results using time tolerances. Some test cases, such as real-time tests, are affected by timing attributes of the execution environment and shifts in data logged from physical systems. You can account for timing differences by including time tolerance in baseline and equivalence criteria. For details, see Apply Tolerances to Test Criteria.

Simscape Component Support: Create test harnesses for subsystems connected by Simscape physical connections

You can test subsystems connected by Simscape physical connections using test harnesses. Test harnesses isolate Simscape subsystems, providing physical signal ports at the subsystem interface. To define the physical system, add blocks to the test harness. To connect Test Sequence and Test Assessment blocks to the physical system, use Simulink-PS Converter and PS-Simulink Converter blocks.

Expanded API: Edit and manage Test Sequence Blocks with an expanded API

The `sltest.testsequence` API includes additional functions to read, edit, and delete test sequence steps, transitions, and data symbols. Use these functions to create, edit, and manage Test Sequence and Test Assessment blocks. For more information, see the Test Sequence Programming section on the Logic-Based Testing page.

The `'Label'` property name has been changed to `'Action'` to more closely match the functionality of the argument in creating and editing test sequence steps. The change applies to the functions

- `sltest.testsequence.addstepafter`
- `sltest.testsequence.addstepbefore`
- `sltest.testsequence.addstep`
- `sltest.testsequence.editstep`

Compatibility Considerations

If you have a script that uses these functions with the property name `'Label'`, running the script returns a warning that `'Label'` is removed. Update the script to use the property name `'Action'` instead of `'Label'`.

Signal Logging Selection: Specify signals to log in a test case without modifying the model

Using the **Simulation Outputs** section, you can log additional signals in the Test Manager without changing the logging settings in your model. For more information, see Simulation Outputs.

Proof Objective Support for verify() Statements: verify() statements interpreted as proof objectives for Simulink Design Verifier analysis

If your model or test harness contains a `verify()` statement in a Test Assessment or Test Sequence block, Simulink Design Verifier property proving analysis interprets the `verify()` statement as a proof objective. This allows your `verify()` statements to be used for both functional testing and formal analysis, without having to add Proof Objective blocks to the model. Also, for `verify()` statements falsified, you can create counterexamples that falsify the objective during simulation. For more information about property proving, see Prove Properties in a Model (Simulink Design Verifier). For more information about `verify()` statements, see Assess Simulation Using Logical Statements.

Enhanced Reporting: Include MATLAB figures, save report options, and automatically generate reports after testing

- You can include custom MATLAB figures in your report. For details, see Create, Store, and Open MATLAB Figures.
- You can automatically create a report after executing a test file. In the test file, under **Test File Options**, select **Generate report after execution**. The Test Manager displays options for the report, which are saved with the test file. For details, see Export Test Results and Generate Reports.

Test Manager Integration with Simulink Design Verifier: Generate additional tests from within the Test Manager to increase coverage

If you have Simulink Design Verifier, you can generate tests to achieve additional coverage starting from the coverage results pane in the Test Manager. After executing tests, view the cumulative coverage results in the Test Manager results pane. Select the coverage result and click **Add Tests for Missing Coverage**. For an example, see Perform Functional Testing and Analyze Test Coverage.

Test Manager Hierarchies: Expand and collapse trees using context menu

You can expand or collapse hierarchies in the Test Manager using the context menu. For example, in the **Test Browser** pane, right-click a test file or test suite. From the context menu, select **Expand All** or **Collapse All**. A similar context menu item appears in hierarchies in the **Results and Artifacts** pane.

Stop simulation at the end of test input data

If you have timeseries test input data, you can limit the simulation data output by stopping simulation at the end of the test input timeseries. For example, if your input data stops after 10 seconds, but your model simulation time is set to 300 seconds, limit the simulation to avoid 290 seconds of unnecessary data. Select **Stop simulation at last time point** in the **Inputs** section of the test case definition.

Capture baseline data from test case iterations

If your test case is configured with table iterations, you can capture baseline data from logged signals using a one-click process. Baseline criteria is captured in a separate file for each iteration, and each baseline data file appears with its corresponding iteration in the iterations table. For an example, see Capture Baseline Data from Iterations.

Simplify test editor view by hiding unused sections

You can simplify the view for test files, test suites, and test cases by hiding unused test sections. In the Test Manager, click the **Preferences** button in the toolbar, and select

sections to hide or display. Populated sections are always displayed. This is a global Test Manager setting. To customize view for multiple users, you can set the preferences programmatically using `sltest.testmanager.getpref` and `sltest.testmanager.setpref`. For more information, see Test Sections.

Test Case Conversion: Convert desktop simulation test cases to real-time test cases

You can convert test cases that run on desktop simulation into real-time test cases. In the **Test Browser**, right-click the test case name and select **Convert to > Real-Time Test**.

Data dimension settings for certain test harness inputs

When you create a test harness using From Workspace, From File, or Constant blocks as sources, the default value of the source reflects dimensions of the signal.

Run MATLAB Unit Tests in Fast Restart mode

The MATLAB Unit Test framework supports Fast Restart mode for running test cases authored in Simulink Test.

R2016b

Version: 2.1

New Features

Bug Fixes

Custom Criteria: Define custom criteria for test case evaluation

You can customize test case pass and fail criteria using MATLAB and the MATLAB Unit Testing framework. Use custom criteria in addition to assessments such as `verify` statements and timeseries comparisons. For example, assess the final value of a signal, set a maximum threshold, or post-process signal results using MATLAB toolboxes. With MATLAB Unit Test, qualifications return `pass` or `fail` results to the Test Manager. See Apply Custom Criteria to Test Cases.

MATLAB Unit Test Integration: Use MATLAB Unit Test to execute and integrate tests

You can run tests authored in Simulink Test using the MATLAB Unit Test framework. This allows you to combine execution of tests authored in both frameworks. You can customize test execution with a test runner, and access test results in MATLAB.

With the MATLAB Unit Test framework, you can set up systematic testing using continuous integration systems. Use plugins such as the `TAPPPlugin` to create results that are compatible with CI systems such as Jenkins. See Test Models Using MATLAB Unit Test.

Test Case Tagging: Filter and execute tests using custom tags

You can group tests by assigning custom tags to test cases and suites, and filter tests to view test case subsets. Running filtered tests can save time compared to running a full test suite. Filter tests in the test browser using the syntax `tag:<name>`. To run filtered tests, expand the drop-down menu under **Run** and select **Run filtered**. See Filter Test Execution and Results.

Graphical Output for Model Verification Blocks: Analyze results from Assertion and Model Verification blocks in Simulation Data Inspector and the Test Manager

Blocks in the Model Verification library return a `pass` or `fail` result to the Test Manager, using semantics similar to a `verify` statement. Viewing results graphically helps you to:

- Determine the time when a failure occurs.
- Debug the model by comparing the verification result with relevant signals.
- Trace failures from the graphical results to the model.

See View Graphical Results From Model Verification Library.

Initialize and Terminate Functions: Test harnesses include calls for initialize and terminate systems in a model

When you create a test harness for a model block diagram, you can include calls to initialize and terminate systems. The test harness creates a Test Sequence block configured to schedule function calls to initialize and terminate systems.

Harness Requirements Linking: Establish requirements traceability for external test harnesses

Requirements linking is supported for test harnesses that are stored externally as independent SLX files.

Test Case Conversion: Convert test cases between baseline, equivalence, and simulation test types

You can convert existing test cases between baseline, equivalence, and simulation test types. This helps facilitate test case reuse. For example, to reuse an existing baseline test as an equivalence test, copy the baseline test and change the copied test case to an equivalence test. To convert a test case,

1. In the Test Browser, right-click the test case name.
2. Select **Convert to > Baseline Test / Equivalence Test / Simulation Test**.

Additional Report Templates: Create PDF and HTML reports using report templates

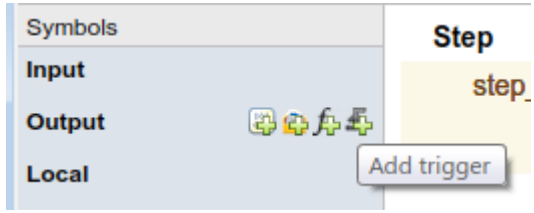
With a MATLAB Report Generator™ license, you can create custom PDF and HTML reports from the Test Manager using report templates. In the Create Test Result Report

dialog box, select a PDFTX or HTMTX template file. For more information, see Export Test Results and Generate Reports, and Create Report Templates.

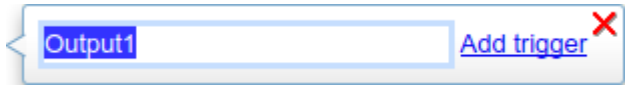
Output Event Definition: Create Test Sequences that trigger actions in other subsystems

You can use trigger outputs in a Test Sequence block or Test Assessment block to activate a triggered subsystem or signal an event in a Stateflow® chart. To create a trigger output in a Test Sequence block,

1. In the test sequence editor **Symbols** pane, click the **Add trigger** icon next to the **Output** section.



2. Enter the output name, and click **Add trigger**.



3. Trigger outputs initialize to 0. In the test sequence, use the `send` command to activate the trigger output.

```
send(Output1)
```

Access verify statement output using a programmatic interface

Simulation data output from `verify` statements are available via a programmatic interface. To get assessment results, use the `sltest.getAssessments` function.

Revised visualization for verify statements and other assessments

The Test Manager displays `verify` statement results and other assessments using a stem plot, which plots the `verify` output data as stems extending from a baseline along the x-axis. The baseline is a `pass` result, with stems extending from the baseline for `untested` and `fail` results. Data color corresponds to the statement result:

Color	Result
Red	`Fail`
Green	`Pass`
Gray	`Untested`

To maintain readability, plots adjust the data displayed if the result is the same for numerous consecutive data points. Zooming in to smaller x-axis intervals displays additional discrete data points. Changes in result are always displayed, for example, from `pass` to `fail`. See Assess Simulation Using Logical Statements for an example. To get assessment results programmatically, use the `sltest.getAssessments` function.

Common test harness sources and sinks for signal and control inputs, and revised signal routing

When you create a test harness, additional inputs are connected to the specified harness source and sink type, rather than to Inport or Outport blocks. Additional inputs expand your ability to drive component inputs with a single source type for:

- Control inputs
- Function call inputs
- Data store memory
- Goto and From blocks
- Export function models
- Simulink functions

To simplify test harness block diagrams, the signal routing uses Goto and From blocks to connect component under test input and output signals to Test Assessment blocks. Also, some signal routing blocks are contained in input and output conversion subsystems.

Add baseline criteria using expected outputs captured by Simulink Design Verifier

Simulation output captured by running Simulink Design Verifier tests are now included as baseline data in test cases exported from Simulink Design Verifier to Simulink Test.

Set SIL or PIL simulation mode from the Test Manager for a model referenced by a test harness

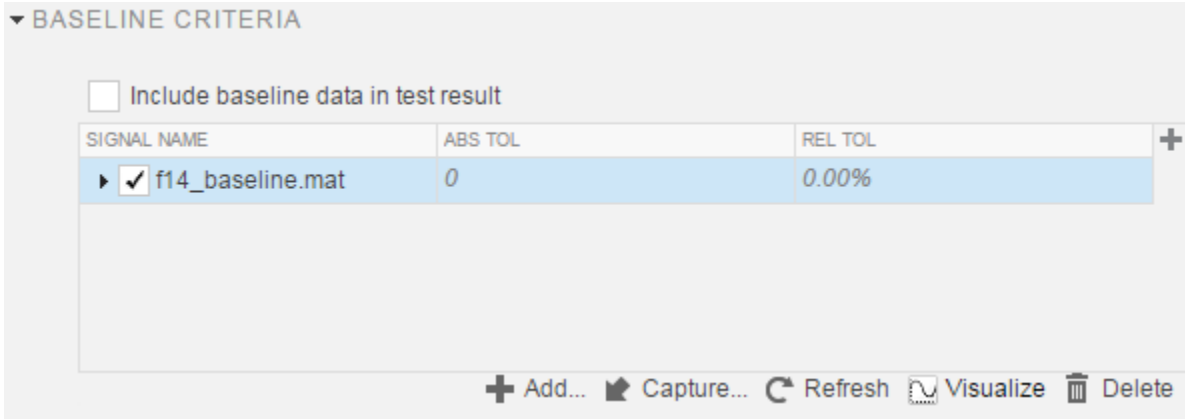
From the Test Manager, you can override the simulation mode to software-in-the-loop (SIL) or processor-in-the-loop (PIL) for a model referenced by a component under test in a test harness. Overriding the referenced model simulation model applies to test harnesses for block diagrams and test harnesses for Model blocks, since these types of test harnesses use Model blocks as the component under test. Setting the simulation mode from the Test Manager allows you to use an equivalence test and a single test harness to perform SIL or PIL output equivalence verification.

Highlight dependencies in test harnesses using Model Slicer

If you have a Simulink Design Verifier license, you can use the Model Slicer to highlight functional dependencies in test harnesses created by Simulink Test. Highlighting functional dependencies helps you analyze behavior in large or complex test harnesses. See Highlight Functional Dependencies.

View baseline data graphically

In the Test Manager, you can view a graph of test case baseline data. This facilitates reviewing the baseline data before you map it to a test case and run tests. In the **Baseline Criteria** section of the test case, highlight the signal name and click **Visualize**. The graph appears in the Simulation Data Inspector.


BASELINE CRITERIA
Include baseline data in test result
SIGNAL NAME
ABS TOL
REL TOL
f14_baseline.mat
0
0.00%
Add...
Capture...
Refresh
Visualize
Delete

R2016a

Version: 2.0

New Features

Bug Fixes

Real-Time Testing: Author and execute real-time tests with Simulink Real-Time

A new Real-Time Test builds a Simulink Real-Time™ application from your model or test harness and runs it on a target computer. You can assess the real-time execution using `verify` statements, and collect real-time data for analysis in the Test Manager. See Test Models in Real Time.

verify Statement: Author test sequence assessments to verify simulation behavior without stopping the simulation

In the Test Sequence and Test Assessment blocks, you can use `verify` statements to assess a logical condition without stopping simulation. A `verify` statement returns a fail, pass, or untested result. Results of each `verify` statement appear in the Test Manager. See Assess Simulation Using Logical Statements.

Test Report Customization: Customize test result reports using Simulink Report Generator

You can write scripts to customize the details of Test Manager result reports such as text formatting, output plots, headers and footers, layouts, and more. See Customize Generated Reports.

External Test Harnesses: Save Simulink Test harnesses as external files

You can opt to save your test harnesses externally, as independent SLX files. External test harnesses allow you to create or change test harnesses without changing the model SLX file, which is useful for models under change management. External harnesses provide the same synchronization and push/rebuild capability as internal harnesses saved with the model SLX file. See Manage Test Harnesses.

Test Iterations: Create tests with iterations such as parameters and input vectors

To test and sweep through a range of parameters, inputs, and other test case settings, you can author and organize many tests in one place using iterations. To help create

iterations, templates are available for Signal Builder groups, parameter sets, inputs, configuration settings, and baseline criteria. You can run iterations using fast restart if it is supported by your model. See Run Multiple Combinations of Tests Using Iterations.

Test generated using Simulink Design Verifier now appear as iterations in a test case rather than separate test cases in a test suite.

Aggregate Coverage Results: Aggregate Simulink Verification and Validation coverage results across executed tests

If you have a Simulink Verification and Validation license, then you can collect the coverage results from your tests. The results are aggregated at test case, test suite, and test file levels. Coverage results can also be included in the Test Manager results report. See Collect Coverage in Tests.

Parallel Test Execution: Distribute test execution in parallel to decrease test run time

If you have a Parallel Computing Toolbox™ license, then you can run tests in parallel across multiple workers on the same machine to decrease test execution time. See Run Tests Using Parallel Execution.

Test Harness for Libraries: Create and manage test harnesses for library components

You can create test harnesses for library blocks and move test harnesses from linked blocks to the library source. See Test Library Blocks.

Requirement Traceability: Link to requirements in test harnesses and test sequences

If you have a Simulink Verification and Validation license, you can create requirements links for model objects in internally stored test harnesses. Requirement links for the component under test synchronize between the main model and the test harness. You can also create requirements links for test steps in Test Sequence and Test Assessment blocks. See Link Tests to Requirements.

Simulink and Export Function Support: Create test harnesses for models containing Simulink functions and export functions

If you generate a harness for a model configured to export functions, the harness will contain a new Test Sequence block that schedules the function-call signals and Simulink Functions in the export-function model. You choose the sources and sinks for other subsystem inputs and outputs. See Test Models that use Export Functions for AUTOSAR-Compliant Code.

Test Assessment block available for all harness sources

The Simulink Test library offers a separate Test Assessment block entry. You can include a Test Assessment block with any test harness source using the test harness creation dialog box. The Test Assessment block is a Test Sequence block configured with a default When decomposition sequence and a `verify` statement, which are commonly used in model assessment.

Test Sequence block support for messages

Test Sequence blocks support sending and receiving messages. Messages are objects that carry data and can be queued. You can send a message using a message output and the `send` command, and receive a message using a message input and the `receive` command. When a test step receives a message, it can use the `receive` result or the message data in a step action or transition. See Test Sequence Action and Transition Operations.

Test Sequence Editor enhancements

The Test Sequence Editor offers several enhancements for the Test Sequence and Test Assessment blocks.

- You can add a description for a test step using the **Description** field.
  - Code generated from the block includes test step descriptions as commented code. To include the commented descriptions in generated code, select **Simulink block descriptions** in the **Code Generation** > **Comments** section of the model configuration parameters.
  - Simulink Report Generator includes descriptions in the Test Sequence block reports.

- Syntax highlighting: The Test Sequence Editor includes MATLAB syntax highlighting for improved readability.
- Tab completion: The Test Sequence Editor suggests words, such as data symbols and functions, to complete test step programming syntax. A list appears based on the characters you type. Select a word from the list and press **Tab**, or press **Esc** to close the suggestions.
- Port reordering: You can reorder block inputs and outputs by dragging an **Input** or **Output** symbol name up or down in the **Symbols** sidebar.

Simulink Projects integration

You can create a Simulink project from a test file. When you create a project from a test file, it enables you to perform file dependency analysis. Projects let you easily see the impact that changes could have on tests that might use shared files. You can also run tests directly from the Simulink Projects interface. For more information about Simulink Projects integration, see Manage Test File Dependencies.

Test Generation for Subsystems

You can generate tests for a subsystem in a model from the Test Manager. The Test Manager creates a test harness for the subsystem and enables you to test the subsystem independently, thereby isolating it from the main model. See Generate Test Cases from Model Components.

R2015aSP1

Version: 1.0.1

Bug Fixes

R2015b

Version: 1.1

New Features

Bug Fixes

Expanded Simulink Test API: Automate test creation, editing, and execution using MATLAB scripts

You can use functions, classes, and methods to programmatically:

- Generate test cases from a model based on existing test harnesses and signal builder groups. See `sltest.testmanager.createTestsFromModel`.
- Edit test case simulation properties, parameter sets, and comparison criteria
- Create test files, test suites, and test cases
- Copy and move test suites and test cases
- Run individual test suites and test cases
- Copy a test harness, including its contents, configuration set, properties, and model association, using the `sltest.harness.clone` function

For more information about using the API, see Automate Tests Programmatically.

Test Case Automation: Create test cases with inputs generated by Simulink Design Verifier

Starting with the results of a Simulink Design Verifier analysis, Simulink Test creates test cases that use the inputs generated by Simulink Design Verifier. Test cases appear in the Test Manager and can use an existing or new test harness. See Test Models Using Inputs Generated by Simulink Design Verifier.

Qualification and Certification: Qualify Simulink Test for supported industry standards, including DO-178 and ISO 26262

You can use the IEC Certification Kit and DO Qualification Kit to qualify Simulink Test for supported industry standards, including DO-178, ISO 26262, and IEC 61508.

Enhanced Reporting: Use Microsoft Word templates to customize report generation

If you have a MATLAB Report Generator license, you can insert report items from the Simulink Test generated report into your own Microsoft Word templates. For more information on report generation, see Export Test Results and Generate Reports.

Additional tools for Test Sequence editing and debugging

The test sequence editor includes new tools you can use when creating, editing, and debugging a test sequence, including

- Undo and redo edits
- Cut, copy, and paste test steps using keyboard shortcuts
- Simulation rollback

Simulink Report Generator inclusion for Test Sequence block

You can include data from Test Sequence blocks in a report, using the Test Sequence component in Simulink Report Generator.

R2015a

Version: 1.0

New Features

Introduction to Simulink Test

Simulink Test provides tools for authoring, managing, and systematically executing simulation-based tests. You can create nonintrusive test harnesses to test models and subsystems. You can generate reports, archive and review test results, rerun failed tests, and debug the component or system under test.

Test harness for subsystem and model testing

Test harnesses provide a separate, nonintrusive testing environment for your models. A test harness associates with a particular model or model component and persists with the model. You define tests by adding inputs and assessments to the harness, and you can set harness-specific simulation parameters. The test harness synchronizes model changes to the main model. The Test Manager can access the test harnesses in your model. See Refine, Test, and Debug a Subsystem and Test Harness and Model Relationship.

Test Sequence block for defining tests and assessments

Test Sequence blocks concisely define a series of test steps and transitions using MATLAB action language. Each step defines the block output values and the condition that triggers the transition to another test step. You can define a test step hierarchy using different transition modes. Test Sequence blocks include concise output functions, such as square and sawtooth, and operators that return temporal information, such as the elapsed step time or the duration of a condition.

You can assess the model operation in the test sequence, or in a separate Test Sequence block. See Test Downshift Points of a Transmission Controller and the Test Sequence block.

Test Manager for test authoring and systematic test execution

The Simulink Test Manager enables you to organize and run large sets of tests for Simulink models. Using the Test Manager, you can author and execute test cases individually or as a batch. You can also link to test requirements from each test case if you have a Simulink Verification and Validation license. After you execute tests, the test outcome and any simulation output appear in the **Results and Artifacts** pane of the Test Manager.

Baseline, equivalence, and back-to-back testing with pass-fail criteria

You can test models using baseline and equivalence test case templates in the Test Manager. Baseline test cases compare simulation output to defined expected outputs. Equivalence test cases compare simulation output a second simulation. The simulation output comparison is evaluated according to absolute or relative tolerances, which you specify under **Baseline Criteria** or **Equivalence Criteria**. For more information on tolerances, see How Tolerances Are Applied to Test Criteria.

Archiving and reporting test cases and test results

After you execute tests, you can export the results in the **Results and Artifacts** pane of the Test Manager to a file or save them in a report. For more information on exporting results and generating reports, see Export Test Results and Generate Reports.