

Dymola

Dynamic Modeling Laboratory

Dymola Release Notes

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1 Important notes on Dymola

Installation on Windows

For users of Windows XP and Windows Vista, specific conditions apply. Please see section “Support for Windows XP and Windows Vista” on page 26.

To translate models on Windows, you must also install a supported compiler. The compiler is not distributed with Dymola. Note that administrator privileges are required for installation. Two types of compilers are supported on Windows in Dymola 2015 FD01:

Microsoft Visual Studio C++

This is the recommended compiler for professional users. Note that **free** Microsoft compiler versions earlier than Microsoft Visual Studio Express 2008 are not supported (concerning **full** versions, some earlier versions are supported). Refer to section “Compilers” on page 53 for more information.

GCC

Dymola 2015 FD01 has limited support for the MinGW GCC compiler. Note:

- To be able to use other solvers than Lsodar and Dassl, you must also add support for C++ when installing the GCC compiler. Usually you can select this as an add-on when installing GCC.
- There are currently some limitations with GCC:
 - Only ordinary simulation, and DLL, is currently supported (no FMU Export, DDE or OPC servers).
 - Only 32-bit simulation is supported
 - Commercial libraries: Only limited testing has been done; no support for external library resources.
 - No support for run-time license.

Installation on Linux

To translate models, Linux relies on a GCC compiler, which is usually part of the Linux distribution. Refer to section “Supported Linux versions and compilers” on page 54 for more information.

2 About this booklet

This booklet covers Dymola 2015 FD01. The disposition is similar to the one in Dymola User Manual Volume 1 and 2; the same main headings are being used (except for, e.g., Libraries and Documentation).

3 Dymola 2015 FD01

3.1 Introduction

3.1.1 Additions and improvements in Dymola

A number of improvements and additions have been implemented in Dymola 2015 FD01. In particular, Dymola 2015 FD01 provides:

- Support for FMI 2.0 (page 38)
- Extended FMI support:
 - On Windows, the handling of external resources is now also supported for FMI 2.0. (It was previously already supported for FMI 1.0.) (page 38).
 - On Windows, Co-simulation export of FMUs with Dymola solvers is now also supported for FMI 2.0. (It was previously already supported for FMI 1.0) (page 38).
 - 64-bit export of FMUs on Linux (page 38).
- Simulation speed-up:
 - Multi-core support (page 17).
 - More efficient event handling (page 19).
- Infinite diagram layer (page 10).
- Extended connection dialog (in particular for connection of instances with many scalar input/outputs) (page 9).
- Improved bus signal tracing (page 11).
- Support of favorite packages (page 10).
- Improved scripting (page 20).
- Improved export
 - Diagram/icon layer as SVG (page 14).
 - Plots as SVG (page 19).
 - Animation as X3D (page 19).
 - Improved VRML export (page 20).
- Extended Linux support
 - 64-bit Dymola distribution (page 27).
 - 64-bit FMU Export (page 38).
 - FLEXnet license server upgraded to 11.11 (page 28).
- Visual Studio 2013 supported (page 26).
- JavaScript interface to Dymola (page 30).

- Report generator (page 31).
- Support of Windows 8.1 (page 26).
- GCC compiler support extended on Windows (page 27):
 - DLL export supported
- For users of Windows XP and Windows Vista, specific conditions apply (page 26).

3.1.2 New and updated libraries

New libraries

No new libraries are released in Dymola 2015 FD01.

Updated libraries

The following libraries have been updated:

- Air Conditioning Library, version 1.9.
- DataFiles Library, version 1.0.2.
- Dymola Commands Library, version 1.1.
- Electric Power Library, version 2.2.
- Engine Dynamics Library, version 1.2.2.
- Fuel Cell Library, version 1.3.
- Heat Exchanger Library, version 1.2.
- Hydraulics Library, version 4.1.
- Hydro Power Library, version 2.4.1.
- Liquid Cooling Library, version 1.3.
- Model Management Library, version 1.1.3.
- Modelica_LinearSystems2, version 2.3.2.
- Pneumatics Library, version 1.6.3.
- Power Train Library, version 2.3.0.
- Thermal Power Library, version 1.9.
- Vapor Cycle Library, version 1.2.
- Vehicle Dynamics Library, version 2.0.

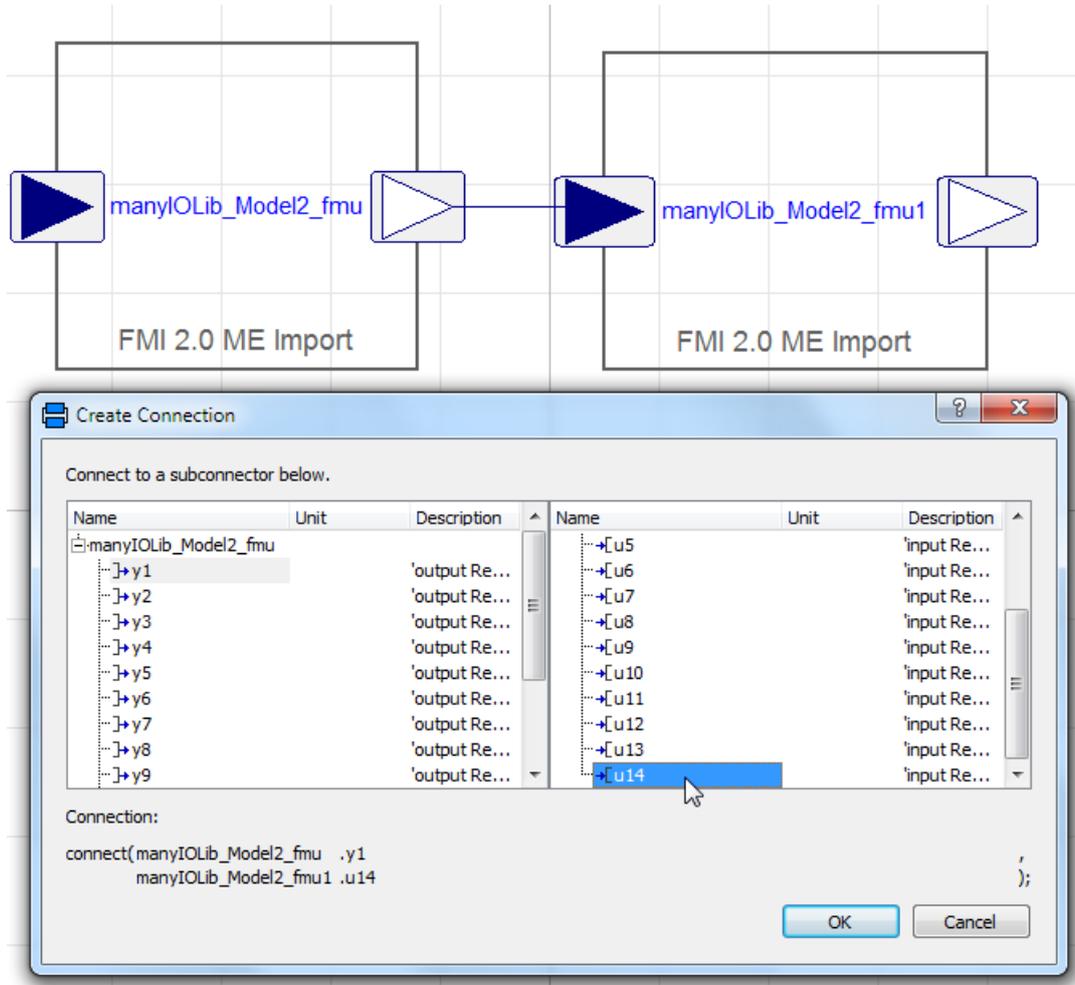
For more information about the updated libraries, please see the section “Updated libraries” starting on page 42.

3.2 Developing a model

3.2.1 Extended connection dialog

The connection dialog has been extended to support overlapping (stacked) connectors. The subcomponents selected by the user are shown at the bottom of the dialog.

Below is an example how to use this feature when connecting FMUs with stacked connectors.



Note 1: Only overlapping connectors of the same parent component are supported by this feature.

Note 2: The feature “Smart Connect” is presently not supported when connecting overlapping connectors.

For information about the automatic stacking of connectors when importing FMUs, see section “Improved import of FMUs with many inputs/outputs” on page 41.

3.2.2 Infinite diagram layer

In Dymola 2015 FD01, infinite diagram layer is implemented.

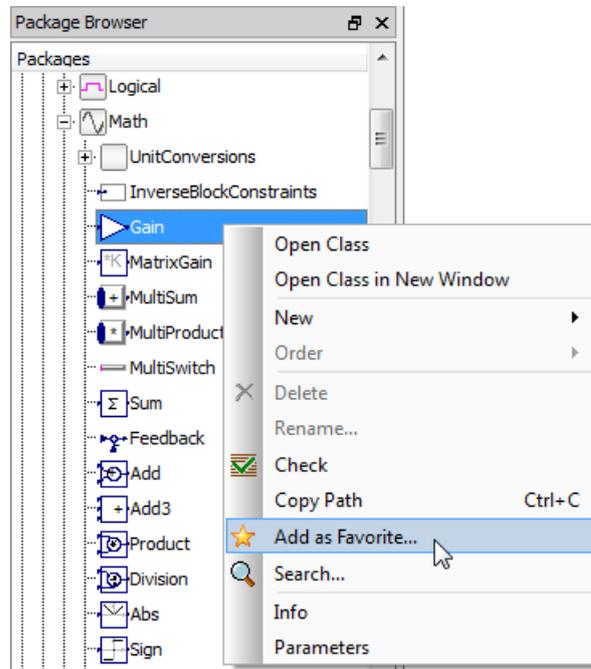
You can move the diagram/icon layer by pressing **Ctrl** while moving the mouse. Scrollbars are no longer needed, and are removed when using this feature.

The feature is by default active, but can be disabled by setting the flag

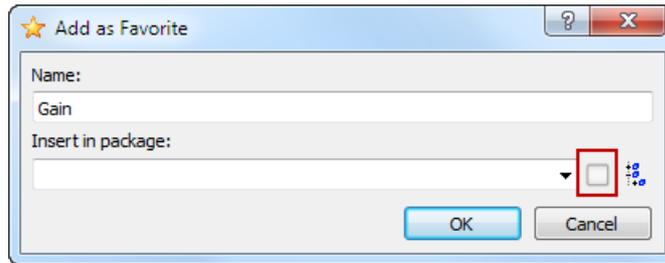
```
Advanced.InfiniteDiagramLayer=false
```

3.2.3 Support of favorite packages

It is possible to create a package containing “favorite” classes, by right-clicking on a class in the package browser, and selecting **Add as Favorite...**,



This opens a simplified class creation dialog:



Here you can select name and package. To create a new package, click the marked icon. This opens the normal Create New Package dialog. The newly created package gets preselected after creation.

To add a currently open class as a favorite, right-click the background of the diagram layer and select **Add as Favorite...**

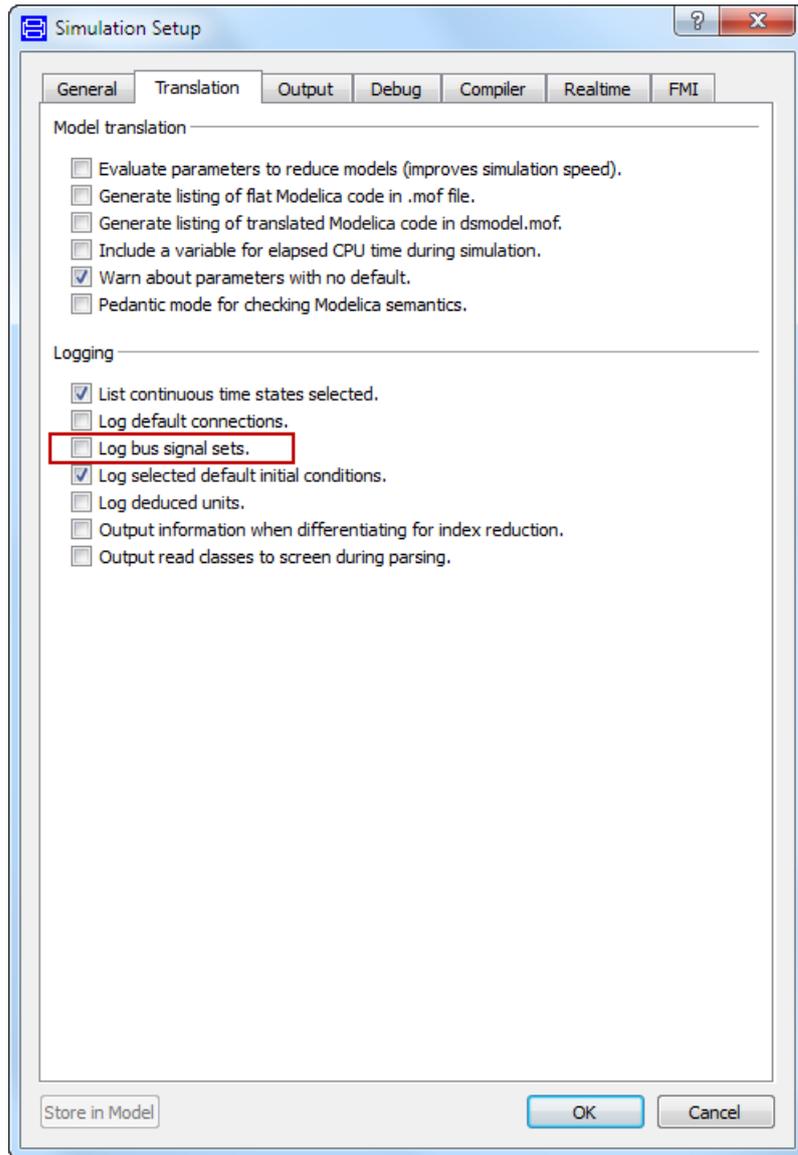
As an example, consider a package of favorites: `Favorites`.

The `Favorites` package looks like an ordinary package, but behaves differently:

- When you open the `Favorites` package, the favorite classes in it will not be loaded (except that Modelica Standard Library will be opened).
- If you have a favorite (made from `Modelica.Blocks.Math.Gain`), drag-and-drop of this class will insert a `Modelica.Blocks.Math.Gain` component, not a `Favorites.Gain` component.
- A favorite package is similar, if you have as favorite the package `Math` (made from `Modelica.Blocks.Math`), drag-and-drop of its `Gain` will insert a `Modelica.Blocks.Math.Gain` component, not a `Favorites.Math.Gain` component.

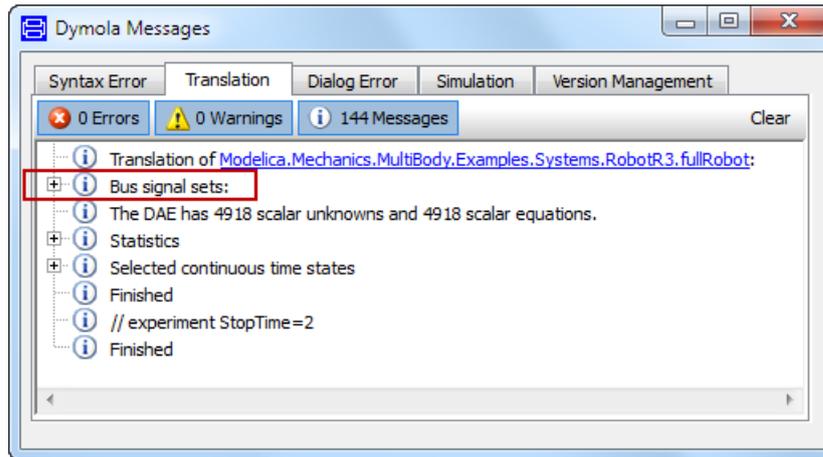
3.2.4 Improved bus signal tracing

The tracing of bus signals (expandable connectors) has been improved; by setting **Log bus signal sets** in the simulation setup. This setting is reached by the command **Simulation > Setup...**, the **Translation** tab.



This setting is by default not activated. Activating this setting corresponds to setting the flag `Advanced.LogBusSignalSets=true`.

When the setting is active, you get a new entry in the **Translation** tab of the Command log (if the model has expandable connectors, like for example the Robot demo).



Expanding this display several instances like:

+ **i** Bus-signal: speed_ref
 Source: [connect\(pathPlanning.pathToAxis1.qd_axisUsed.v, pathPlanning.pathToAxis1.axisControlBus.speed_ref\);](#)
 Use: [connect\(axis1.controller.axisControlBus.speed_ref, axis1.controller.gain2.u\);](#)
 Use: [connect\(axis1.axisControlBus.speed_ref, axis1.initializeFlange.w_start\);](#)

Source means that a causal signal originates at that place, and **Use** that the signal is used at that place. Clicking on a link highlights both components of connect-statement in the diagram layer.

The node can be opened to show detailed content (this information is also shown for some errors in order to help with localizing the error).

+ **i** Bus-signal: speed_ref
 Source: [connect\(pathPlanning.pathToAxis1.qd_axisUsed.v, pathPlanning.pathToAxis1.axisControlBus.speed_ref\);](#)
 Use: [connect\(axis1.controller.axisControlBus.speed_ref, axis1.controller.gain2.u\);](#)
 Use: [connect\(axis1.axisControlBus.speed_ref, axis1.initializeFlange.w_start\);](#)

i Connected bus variables:
 output [pathPlanning.pathToAxis1.axisControlBus.speed_ref](#) "Reference speed of axis flange"
[pathPlanning.controlBus.axisControlBus1.speed_ref](#)
[axis1.motor.axisControlBus.speed_ref](#)
[controlBus.axisControlBus1.speed_ref](#)
 input [axis1.controller.axisControlBus.speed_ref](#)
 input [axis1.axisControlBus.speed_ref](#)

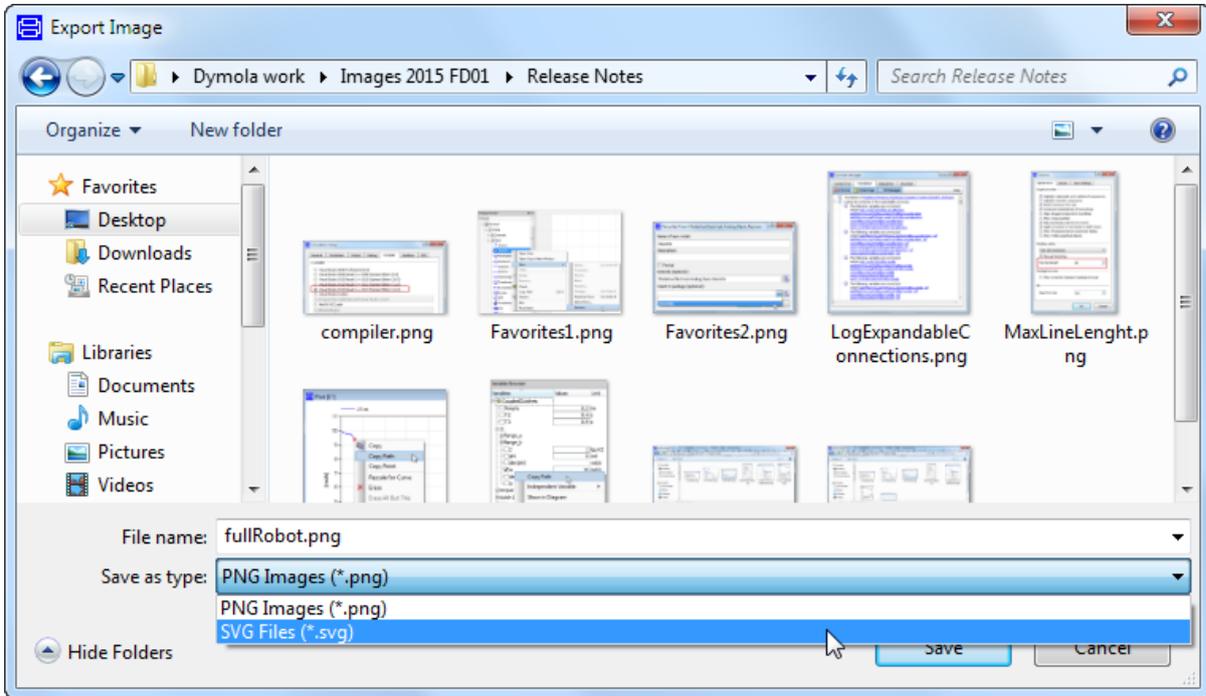
Note:

- **Source** without **Use** means that the signal is not used.
- **Use** without **Source** means:
 - For a physical signal (pin, flange) this is normal.
 - For a causal signal this means that the model is incomplete (except that if the model has a public top level bus it will automatically get one external input).

- Neither **Source** nor **Use**: The signal is only present in the connector definition and is not used.

3.2.5 Improved export of images of diagram/icon layer

In Dymola 2015 FD01, images of diagram layer/icon layer can be exported also to SVG files, using the command **File > Export > Image...**:



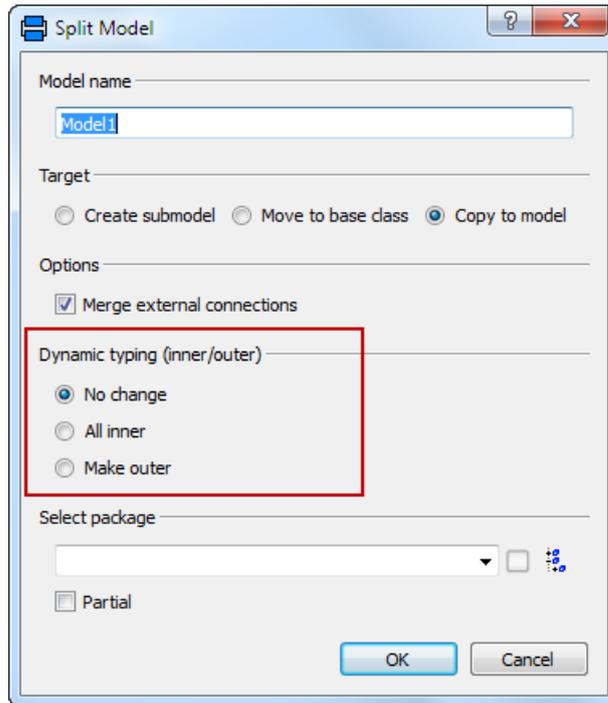
3.2.6 Minor improvements

Extended UNC path support

The current directory can now be an UNC path on Windows. Note: Compilation is handled by copying to a temporary directory.

Improved “Copy to Model” alternative when using “Split Model”

The **Copy to Model** alternative when using **Split Model** now has **Dynamic typing** selections:



The options are:

- **No change** (default). No special treatment of inner/outer components.
- **All inner**: Intended to make a model that can be run directly. All inner components visible from the selected sub-components are included.
- **Make outer**: Intended to make a reusable sub-system. Any used inner component is replaced by a corresponding outer component.

This **Dynamic typing** choice is remembered between calls, and is also available as: `Advanced.SplitModelDynamicVariant`.

The **Dynamic typing** choice is only available for **Copy to model**.

The alternative **Move to base class** has no special treatment of inner/outer components.

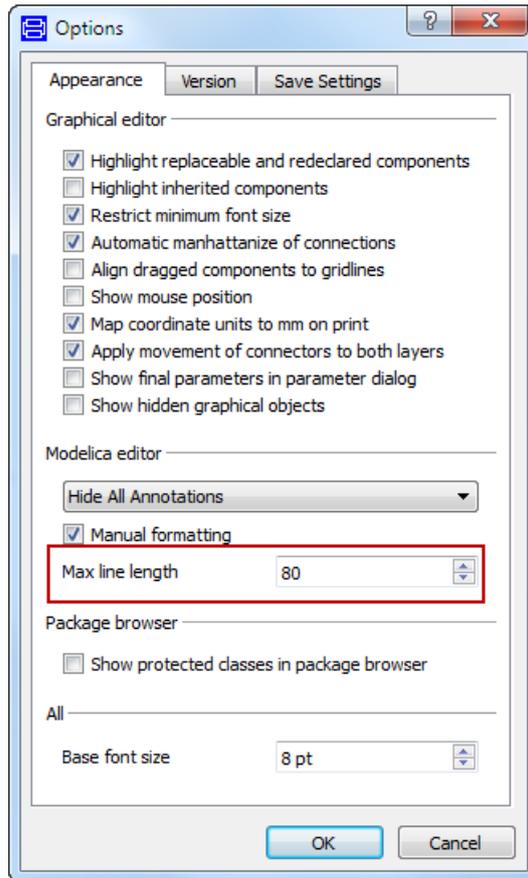
The alternative **Create submodel** already had similar treatment as **Make outer**, since it is intended to create re-usable sub-systems.

String parameter input can be quoted by a context command

Having entered a value in the input box for a string parameter in the parameter dialog, the input can be quoted by right-clicking and selecting **Quote String**.

Adjustable default value of max line length for the Modelica text editor

The default value of the maximum line length in the Modelica text editor can now be set using the command **Edit > Options...**, in the **Appearance** tab:



Values less than 50 cannot be set. The setting corresponds to the flag `Advanced.MaxLineLength`.

The value can be stored in the setup together with other setting in the **Appearance** tab, by using the **Save Setting** tab.

3.3 Simulating a model

3.3.1 Simulation speed-up

Multi-core support

Dymola can parallelize the evaluation of model equations for calculation of the derivatives for continuous-time integration.

This feature is activated by setting the flag

```
Advanced.ParallelizeCode = true
```

Dymola automatically inquires the number of cores.

Notes:

- Hyper-threading is included in this number, i.e. a dual-core processor is seen as 4 cores, and a quad-core as 8 cores.
- The Dymola calculated number of cores is seen in the command log (see below).

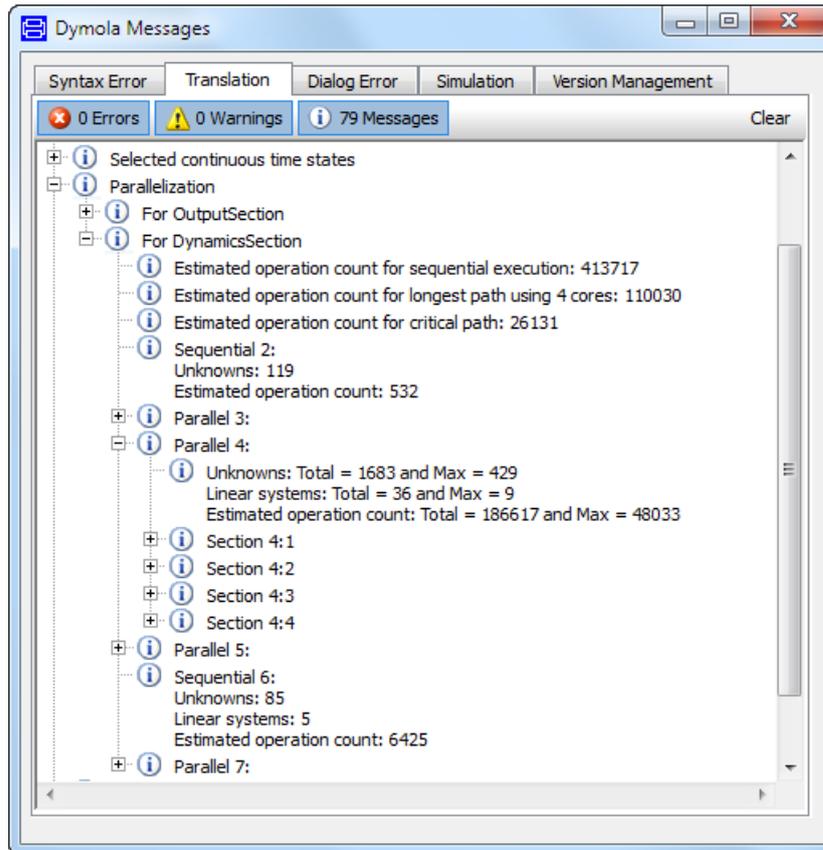
If a certain number of cores are to be used (including hyper-threading as above), the flag `Advanced.NumberOfCores` can be set to any wanted (positive) number of cores, this value overrides the automatically calculated value. An example of using this flag is when you want to create code for a machine with a higher number of cores than the machine you work on. To go back to using the automatically calculated number of cores instead, set this flag to 0. (This is also the default value of the flag.)

Notes:

- The compiler used must support OpenMP. For Visual Studio this means that you must use Visual Studio Professional 2010 or later, or Visual Studio Express 2012 or later. On Windows, the GCC version that Dymola supports, also supports OpenMP.
- Multi-core simulation is currently only supported for `dassl`, `lsodar`, `euler` and `rkfix`, when neither using DLL nor embedded server (DDE).
- For source code generation the generated C-code will contain standard OpenMP-pragmas that are supported by many compilers (see their documentation).

At translation Dymola finds out which equations that can be executed in parallel. The result is a sequence of layers, where the layers have sections that can be executed in parallel.

The translation produces a log to be found in the log window.



The log reports that the calculation of the derivatives (the DynamicsSection) includes 413717 operations, while for the parallelization using 4 cores the longest path is 110030 operations, which means an estimated speed-up of 3.76.

The critical path is estimated to have 26131 operations, i.e., the Amdahl speed-up factor is $413717/26131 = 15.3$, which indicates an upper limit of what could be obtained having many cores and neglecting overhead.

The log then reports the structure of the parallelization obtained. First there is a sequential part calculating 119 unknowns followed by 3 parallel layers, a sequential part and finally a parallel layer. The log for the parallel layer 4 is opened up and it reports that there are 4 parallel sections.

Dymola supports profiling. It is activated by setting `Advanced.GenerateBlockTimers = true` as usual. If parallelization has been activated at translation, the profiling result will also include timing results for the sequences and the parallel layers as well as for the individual sections. These are identified by `Seq[i]`, `Par[i]` and `Sec[i:j]` where `i` and `j` are the numbers given in the log above.

The method for parallelization is described in the paper: H. Elmqvist, S.E. Mattsson and H. Olsson: “Parallel Model Execution on many cores”, Proceedings of the 10th Internal Modelica Conference:

https://www.modelica.org/events/modelica2014/proceedings/html/submissions/ECP14096363_ElmqvistMattssonOlsson.pdf

This paper includes successful uses from the thermodynamic and the electrical domains giving speed-ups of 2.9-3.4 on a quad-core machine.

It should be noted that for many kinds of models the internal dependencies don't allow efficient parallelization for getting any substantial speed-up.

More efficient event handling

Setting the flag

```
Advanced.EfficientMinorEvents = true;
```

activates more efficient handling of “minor” events.

These are events that either do not influence the continuous model at all (these events will be skipped; this is likely to occur when sub-sampling signals in synchronous models), or events that do not require a new Jacobian (sampled input to a continuous model; not implemented yet for Isodar and dassl).

The efficient event handling is not approximate in itself, but due to fewer Jacobians and slight changes in the simulation intervals for the numerical solvers, the results may change within the tolerance.

3.3.2 Plot window

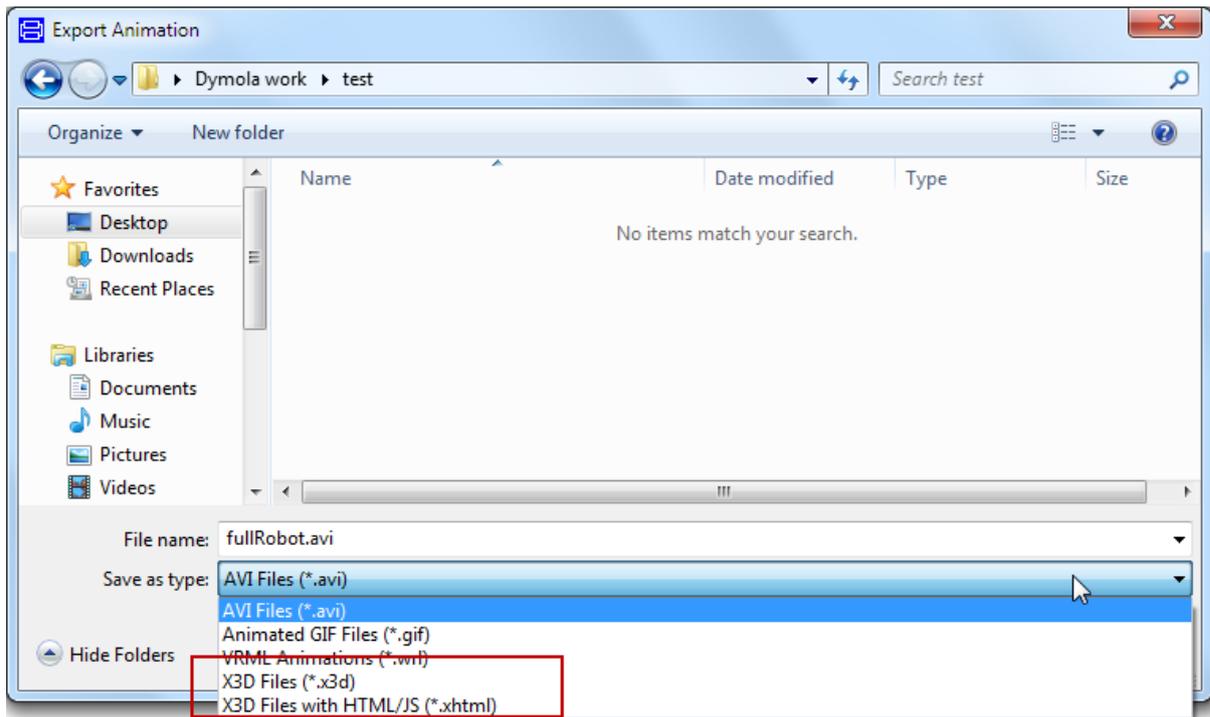
Improved export of plot images

In Dymola 2015 FD01, images of plots can be exported also to SVG files, using the command **File > Export > Image...**; see “Improved export of images of diagram/icon layer” on page 14 for image.

3.3.3 Animation window

Export of animation as X3D supported

In Dymola 2015 FD01, exporting animations in X3D format is supported, by using the command **File > Export > Animation...**



There are two possibilities to export to X3D files:

- Pure XML.
- As XHTML (HTML/JS). When exporting to this file format, an external library, X3DOM, is used.

Improved VRML export

The export to VRML files has been improved:

- Objects are seen in the same view as in the animation window.
- “Follow” is implemented.

3.3.4 Scripting

The library `DymolaCommands` reviewed and updated, and automatically opened

New command group “Documentation” added

A new subpackage `Documentation` has been added in `DymolaCommand`, to support export of, for example, diagram and equations, to create dynamic reports.

Improved documentation of the commands

The documentation of a number of commands in DymolaCommands has been improved, for most commands examples are given in the documentation.

New commands

The commands in the “New commands” section below have been added to the DymolaCommands library.

The commands have been added in the following groups in DymolaCommands:

Group	Commands	Comment
SimulatorAPI	getExperiment	
	setClassText	
Plot	clearPlot	
	signalOperatorValue	
Animation	exportAnimation	
Documentation	exportDiagram	New group
	exportDocumentation	
	exportEquations	
	exportIcon	
	getClassText	

More commands included

Apart from the new commands introduced, the previously available command `listfunctions(filter="*")` has been added to DymolaCommands, to the SimulatorAPI group. The function is used to list built-in functions. The wildcards * and ? can be used in the filter.

Commands removed from DymolaCommands

The following commands have been removed from DymolaCommands due to low usability; they are however still accessible in Dymola.

- continue
- experiment
- SetVariable
- readDataFromFile
- RestoreWindow
- writeToFile

Automatic opening of library

In Dymola 2015 FD01, DymolaCommands is automatically opened, like the Modelica Standard Library.

Different functionality of the two documentation commands

A difference between the commands `help` and `document` has been introduced; `help` displays a short description of the command, while `document` displays more information.

Example: Typing **help importFMU** in the command input line of the Command log window, and pressing **Enter**, gives:

```
function importFMU "Import an FMU"
  input String fileName "The FMU file";
  input Boolean includeAllVariables := true "Include other variables than inputs, outputs and parameters";
  input Boolean integrate := true "Integrate outside the FMU, set to false for co-simulation";
  input Boolean promptReplacement := false "Prompt for name and save location when importing";
  input String packageName := "" "Name of package to insert FMU in";
  output Boolean result "True if successful";
  external "builtin";
end importFMU;
```

Typing **document("importFMU")**, and pressing **Enter**, gives:

```
function importFMU "Import an FMU"
  input String fileName "The FMU file";
  input Boolean includeAllVariables := true "Include other variables than inputs, outputs and parameters";
  input Boolean integrate := true "Integrate outside the FMU, set to false for co-simulation";
  input Boolean promptReplacement := false "Prompt for name and save location when importing";
  input String packageName := "" "Name of package to insert FMU in";
  output Boolean result "True if successful";
  external "builtin";
  annotation(Documentation(info="
```

Imports an FMU, i. e. unzips, XSL transforms the model description and opens the resulting Modelica model. Note: The model description file from any previous import is replaced. This also applies to the binary library files.

This built-in function corresponds to the command **File > Import > FMU...**

For more information, please see the manual "Dymola User Manual Volume 2", chapter 6 "Other Simulation Environments", section "FMI Support in Dymola".

Note: For big models it is recommended to set `includeAllVariables=false` to avoid the Modelica wrapper becoming huge.

Example

```
importFMU("C:/test/Modelica_Mechanics_Rotational_Examples_CoupledClutches.fmu", true, true, false, "");
});end importFMU;
```

New commands

A number of new commands (built-in functions) have been added, for example to support the report generator:

`clearPlot`

```
clearPlot(id=0)
```

Erase curves and annotations in the diagram. Id is identity of window (0 means last).

exportAnimation

```
exportAnimation(path, width=-1, height=-1)
```

Exports an animation to file. Supported file formats are AVI, VRML, and X3D. The file format is determined by the file extension. Use wrl as file extension for VRML.

If there is more than one animation window, the last window is used.

width and height are only applicable for X3D files.

exportDiagram

```
exportDiagram(path, width=400, height=400, trim=true)
```

Export the diagram layer to a file. Supported file formats are PNG and SVG. The file format is determined by the file extension. To export in SVG, the diagram layer must exist.

exportDocumentation

```
exportDocumentation(path, className)
```

Export the documentation for a model to an HTML file.

exportEquations

```
exportEquations(path)
```

Export the equations to file. Supported file formats are PNG and MathML. The file format is determined by the file extension. Use mml as file extension for MathML.

exportIcon

```
exportIcon(path, width=80, height=80, trim=true)
```

Export the icon layer to a file. Supported file formats are PNG and SVG. The file format is determined by the file extension. To export in SVG, the icon layer must exist.

getClassText

```
getClassText(fullName, includeAnnotations=false,  
formatted=false, classText)
```

Return the Modelica Text (as a string `classText`) for a given model, and also if the model is read-only (the output `readOnly=true` if so). `fullName` is the name of the model, for example `"Modelica.Mechanics.Rotational.Components.Clutch"`. `includeAnnotations` specify if annotations should be included, `formatted` if the text should be returned as HTML (`formatted=true`) or as plain text.

getExperiment

```
getExperiment()
```

Get the current experiment (simulation) setting. Outputs from this command are `StartTime`, `StopTime`, `NumberOfIntervals`, `OutputInterval`, `Algorithm`, `Tolerance`, and `FixedStepSize`.

setClassText

```
setClassText(parentName, fullText)
```

Set the Modelica text for an existing or new class. `parentName` is the package in which to add a class, `fullText` is the Modelica text to add. If the class specified by `parentName` does not exist, it is created. If `parentName` is an empty string, a top level class is created.

signalOperatorValue

```
signalOperatorValue(variablePath, SignalOperator, startTime=-1e100, stopTime=1e100)
```

The command `signalOperatorValue` returns the value of a signal operator for a given variable. An example of a call:

```
signalOperatorValue("J1.w", SignalOperator.ArithmeticMean);
```

The following signal operators are presently supported:

Signal operators:

```
SignalOperator.Min  
SignalOperator.Max  
SignalOperator.ArithmeticMean  
SignalOperator.RectifiedMean  
SignalOperator.RMS  
SignalOperator.ACCoupledRMS  
SignalOperator.SlewRate
```

Note that First Harmonic and Total Harmonic Distortion are not supported by this function,

`startTime` has default value `-1e100` and `stopTime` has default value `1e100`, if the `startTime` is before the simulated interval the start of the simulation is used instead, and if the `stopTime` is after the simulated interval the stop time of the simulation is used instead.

3.3.5 Minor improvements

Interactive parameter tuning

Dymola supports interactive tuning of parameters during simulation runs. The functionality is enabled by setting the flag

```
Advanced.OnlineParameterChanges = true;
```

Setting this flag allows synchronized online parameter changes both from the variable browser and from the parameter dialog of the diagram view in Simulation mode. (The flag is by default false.)

Important: The parameter changes are not stored in the result file.

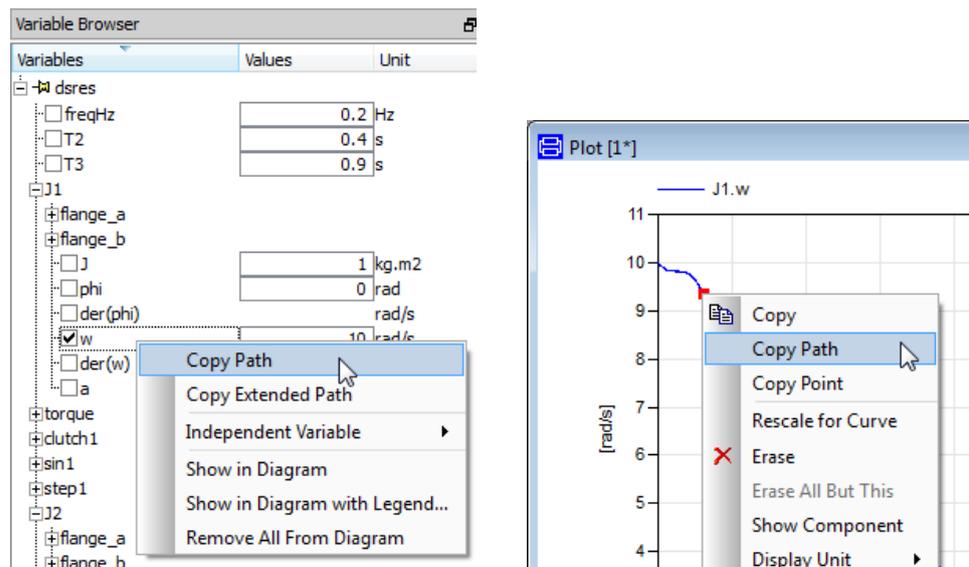
Note. A tunable parameter is an interactive parameter that influences simulation parameters (parameters that appear in simulation equations), but that does not influence parameters which either specify fixed=false or that appear in equations differentiated by Pantelides' algorithm.

Copy Path available for signals in variable browser and plots

The command **Copy Path** is selectable by right-clicking:

- A variable in the variable browser.
- A curve in the plot window.
- A legend in the plot window.

The two first alternatives are illustrated below:



The path is copied to the clipboard.

Copy Extended Path available for signals in variable browser

By right-clicking a variable in the variable browser, the command **Copy Extended Path** is available (see above figure to the left). This command copies the extended variable path to the clipboard. The extended variable path is the variable path with result file name and sequence name (in brackets) included.

Extended support for result file name and sequence name in variable path

Variable paths with result file name and sequence name (in brackets) was previously supported only for the plot expression feature. Now this is supported also for the built-in

functions `createPlot`, `plot`, and `signalOperatorValue`. Commands created when adding signal operators in the GUI now also generate this longer path alternative.

The above commands also support the shorter path alternative. An example of long and short path alternatives is: `"CoupledClutches[end].J1.w"` and `"J1.w"`.

(For the longer name, the sequence name `end` and `end-1` corresponds to the latest and second latest result files; the absolute sequence number can be used in other cases. The shorter name refers to the latest result file.)

3.4 Installation

For the current list of hardware and software requirements, please see chapter “Appendix – Installation: Hardware and Software Requirements” starting on page 53.

3.4.1 Installation on Windows

Operating systems

Windows 8.1 supported

Windows 8.1 is now supported.

Support for Windows XP and Windows Vista

A 32-bit version of Dymola 2015 FD01 supporting Windows XP and Windows Vista is available on request. Please contact your support channel/sales representative for access to download.

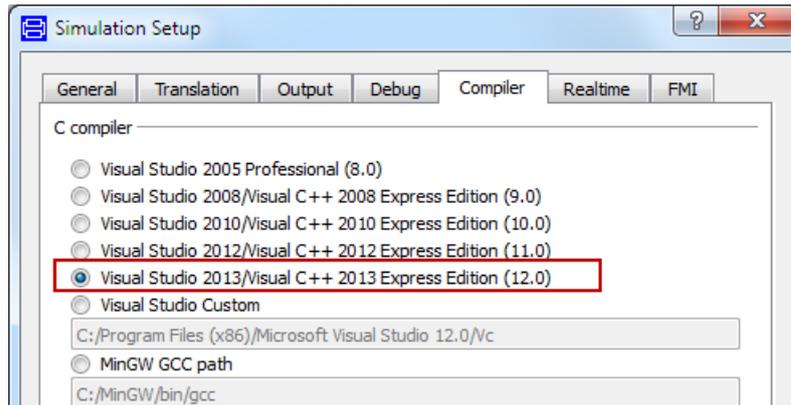
Dymola 2015 FD01 will be the final release to support Windows XP and Windows Vista. In the following Dymola releases, support for Windows XP and Windows Vista will be discontinued.

Compilers

New compiler supported

The new compiler Microsoft Visual Studio 2013 is now supported, both the Professional edition and the Express edition.

For more information on compilers, please see www.Dymola.com/compilers. Note that you need administrator rights to install the compiler.



Note that although the Visual Studio 2013 and 2012 compiler are fully supported, these compilers by default generate a bit less efficient code than previous versions of the compiler, with the selected optimization settings. As a temporary work-around you can set the flag

```
Advanced.Define.GlobalOptimizations = 2;
```

before generating code, to activate global optimization in the compiler. (The default value of the flag is 0.)

This flag works the same for all Visual Studio compilers, but the effect on compilers of previous versions is small. For the Visual Studio 2013 and 2012 compiler, however, the simulation performance is restored, but the compilation of the code might take substantially longer for large models. The setting corresponds to the compiler command `/Og`.

Extended GCC compiler support

DLL mode is now supported for GCC.

3.4.2 Installation on Linux

Dymola now available as a 64-bit application on Linux

Dymola 2015 FD is available as a 64-bit application on Linux. It is included in the distribution. 64-bit export and import of FMUs is also supported.

Note some general requirements concerning jpeg files and 32-bit compilation, see section “Supported Linux versions and compilers” on page 54.

Changed directory structure

From Dymola 2015 FD01, version and architecture are included in the default path for installation and user:

```
/opt/dymola-<version>-<architecture>
```

and

```
/usr/local/bin/dymola-<version>-<architecture>
```

The architecture is RPM standard, and is for 32-bit i586, and for 64-bit x86_64. This gives for example the default directory for a Dymola 2015 FD01 64-bit installation:

```
/opt/dymola-2015FD01-x86_64
```

Note that it is however still possible to start the latest installation of Dymola by `dymola` from a terminal, since a soft link is also created. As an example, if the 2015 FD01 64-bit Linux was the last installed version,

```
/usr/local/bin/dymola
```

corresponds to

```
/usr/local/bin/dymola-2015FD01-x86_64
```

Upgraded FLEXnet license server

The Dymola program and the vendor daemon have been upgraded to version 11.11 of FLEXnet on Linux.

3.5 Other Simulation Environments

3.5.1 Dymola – Matlab interface

Compatibility

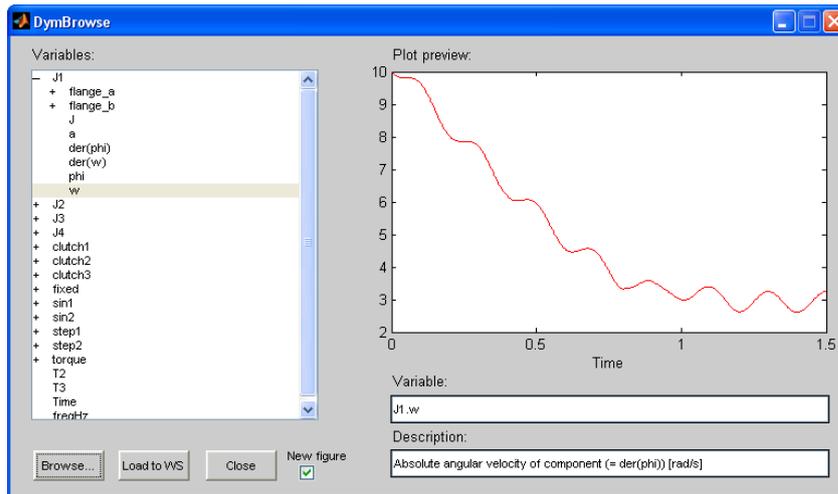
The Dymola – Simulink interface now supports Matlab releases from R2009a (ver. 7.8) up to R2014a (ver. 8.3). Only Visual Studio C++ compilers are supported to generate the DymolaBlock S-function. The LCC compiler is not supported.

Updated dymtools utility

An improved and extended version of the `dymbrowse` command is available in

```
Program Files (x86)\Dymola 2015 FD01\Mfiles\dymtools
```

A Browse button has been added to open new result files together with an option to plot variables in a new Matlab figure. The new version is supported with Matlab R2009b and later.



3.5.2 Real-time simulation

Compatibility – dSPACE

Dymola 2015 FD01 generated code has been verified for compatibility with the following combinations of dSPACE and Matlab releases.

dSPACE DS1005 and DS1006 platforms

- dSPACE Release 6.4 with Matlab R2009a
- dSPACE Release 6.6 with Matlab R2010a
- dSPACE Release 7.0 with Matlab R2009bSP1 and R2010bSP1
- dSPACE Release 7.1 with Matlab R2011a
- dSPACE Release 7.2 with Matlab R2011b
- dSPACE Release 7.3 with Matlab R2012a
- dSPACE Release 7.4 with Matlab R2012b
- dSPACE Release 2013-A with Matlab R2013a
- dSPACE Release 2013-B with Matlab R2013a and R2013b
- dSPACE Release 2014-A with Matlab R2013a, R2013b, and R2014a

SCALEXIO

- dSPACE Release 7.4 with Matlab R2012b
- dSPACE Release 2013-A with Matlab R2013a
- dSPACE Release 2013-B with Matlab R2013a and R2013b
- dSPACE Release 2014-A with Matlab R2013a, R2013b, and R2014a

The selection of supported dSPACE releases focuses on releases that introduce support for a new Matlab release and dSPACE releases that introduce a new version of a cross-compiler

tool. In addition, Dymola always support the three latest dSPACE releases with the three latest Matlab releases. Although not officially supported, it is likely that other combinations should work as well.

Compatibility – xPC Target

Compatibility with Matlab xPC Target has been verified for all Matlab releases that are supported by the Dymola – Simulink interface, which means R2009a (xPC Target ver. 4.1) to R2014a (Simulink Real-Time ver. 6.0). Only Microsoft Visual C compilers have been tested.

3.5.3 JavaScript interface for Dymola on Windows available

The class `DymolaInterface` provides a JavaScript API for accessing the most useful built-in functions in Dymola.

To use the JavaScript interface, Dymola must be started specifying server port 8082, for example by adding this port as the last part of **Target** in a shortcut for starting Dymola:

```
...\Dymola.exe" -serverport 8082
```

There is a one-to-one correspondence between the parameters in a Dymola command and the parameters in the corresponding JavaScript method. **Note** that JavaScript does not support named parameters.

If you want to execute a command that is not part of the Java interface, you can use the method `ExecuteCommand`. It takes a string parameter that can contain any command or expression. For example:

```
dymola.ExecuteCommand("a=1");
```

The command is not type checked so you are responsible for making sure that the command is valid. It is not possible to retrieve the output from the command.

Note! The JavaScript interface is currently only supported on Windows.

The JavaScript interface has been tested on Firefox, Google Chrome, and Internet Explorer 11.

Below an example of how to use the JavaScript interface:

```

try {
    var dymola = new DymolaInterface();
    var result =
dymola.simulateModel("Modelica.Mechanics.Rotational.Examples.CoupledClutches");
    if (result) {
        result = dymola.plot(["J1.w", "J2.w", "J3.w", "J4.w"]);
        if (result) {
            result = dymola.ExportPlotAsImage("C:/temp/plot.png");
        }
    } else {
        alert("Simulation failed.");
        var log = dymola.getLastErrorMessage();
        alert(log);
    }
} catch (e) {
    alert("Exception: " + e);
}

```

For more information about the JavaScript interface, open the file `DymolaInterface.html`, located in

Program Files (x86)\Dymola 2015 FD01\Modelica\Library\
java_interface\doc

with your favorite browser.

3.5.4 Report generator

Fundamentals

In Dymola 2015 FD01 a report generator is available. It is based on Dymola running as a server. It enables a HTML page loaded in a browser to call Modelica functions using JavaScript. It is possible to insert a model diagram, change parameters, simulate a model, show plots, show animations, etc. It can be used as a “notebook” since it’s possible to re-execute function calls, for example to make a simulation with changed parameters and observe the changed plots. The resulting report can then be stored and sent to anyone (the reader does not need Dymola to read the report).

XHTML can be used, as well as HTML5, SVG, WebGL, MathML and X3D (successor standard for VRML). For example, 3D animations can be made directly in a browser using X3DOM which renders 3D animations represented as X3D. It is written in JavaScript and uses WebGL. For animation commands available in the animation, see section “Mouse and keyboard commands available for animation in reports” on page 37 below.

In order to allow calling Modelica functions from HTML, a web server version of Dymola has been developed. All **functions** available in the package `DymolaCommands` are possible to call from JavaScript in the client web browser. An automatic JavaScript generator has been developed. It creates the code for the parameter exchange.

Important.

To support the report generator, Dymola must be started specifying server port 8082, for example by adding this port as the last part of **Target** in a shortcut for starting Dymola:

```
...\Dymola.exe" -serverport 8082
```

Note! The report generator is currently only supported on Windows.

The report generator has been tested on Firefox, Google Chrome, and Internet Explorer 11.

JavaScript functions

A set of special report JavaScript functions has been developed which are suitable to include in the HTML code. When the HTML page is opened, the browser communicates with Dymola to retrieve various information, such as model diagrams, plots, and animations. This information is inserted in the HTML page. It is possible to save the HTML code including this information for use without having Dymola running. It is also possible to re-execute a function call, for example to re-run a simulation after changing parameters.

The functions add content (innerHTML) of HTML div-blocks. The structure of the functions is:

```
insertXXX(result_block, model, ...);
```

The `id` of the div-block is a parameter `block_id`. The model path is given as the parameter `model`. A typical structure of a HTML page is thus:

```
<p>Text</p>
<div id="diagram"></div>
<script type="text/javascript">insertDiagram(diagram, "MyModel", "svg");
</script>
```

The functions are:

insertDiagram(result_block, model, format, width, height)

Inserts a Modelica diagram.

The `format` is either "PNG" or "SVG". The dimensions in pixels are given by `width` and `height`.

insertIcon(result_block, model, format, width, height)

Inserts a Modelica icon.

The `format` is either "PNG" or "SVG". The dimensions in pixels are given by `width` and `height`.

insertText(result_block, model)

Inserts pretty printed Modelica text.

The annotations are omitted from the Modelica text.

insertClass(result_block, model, width, height)

Inserts a Modelica text editor for a given model.

The text of the model can be edited and submitted to Dymola. If the model is read-only, the editor is disabled and the model is not possible to edit.

The dimensions in pixels are given by `width` and `height`.

insertEquations(result_block, model, format)

Inserts the equations and algorithms of a Modelica model.

The `format` is either "PNG" or "MathML".

insertDocumentation(result_block, model, width, height)

Inserts the formatted documentation of a Modelica model.

The dimensions in pixels are given by `width` and `height`.

insertParameterDialog(result_block, model)

Inserts an editor for the top-level parameters in a model.

The parameter values can be changed and submitted to Dymola.

insertCommand(result_block, width, height)

Inserts a command window.

The bottom part is a command-line where any command may be entered. The top part shows the result.

The dimensions in pixels are given by `width` and `height`.

insertPlot(result_block, model, variables, format, width, height)

Inserts a plot.

The array of variables to plot is given by `variables`.

The `format` is either "PNG" or "SVG". The dimensions in pixels are given by `width` and `height`.

insertVariableValue(model, variable, time)

Inserts a variable value. The value is read from the result file.

The variable path is given by `variable`. The time in seconds is given by `time`.

insertSignalOperatorValue(model, variable, signalOperator)

Inserts a signal operator value.

The variable path is given by `variable`. The `signalOperator` is an enumeration value. Here is a list of available signal operators:

```
SignalOperator.Min  
SignalOperator.Max
```

```
SignalOperator.ArithmeticMean
SignalOperator.RectifiedMean
SignalOperator.RMS
SignalOperator.ACCoupledRMS
SignalOperator.SlewRate
SignalOperator.THD
SignalOperator.FirstHarmonic
```

insertAnimation(result_block, model, format, width, height)

Inserts an animation.

The animation is automatically running. You can rotate the animation object by pressing left button and moving the mouse. Pan by also pressing **Ctrl**. Zoom by pressing **Alt**.

The format supported is "X3D". The dimensions in pixels are given by width and height.

The following utility function is also available:

setClassText(package_path, Modelica_text);

Creates or changes a Modelica class.

The complete text definition of a Modelica class is given. It can be inserted in a package. If the package_path is an empty string, a top level class is created.

Example of HTML report sections

Below a small example of how a HTML report can look like:

```
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
"http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">
<head>
  <meta http-equiv="Content-Type" content="application/xhtml+xml; charset=utf-8"/>
  <title>Dymola Report</title>
  <link rel="stylesheet" type="text/css" href="dymola_report.css"/>
  <script type="text/javascript" src="utils.js"></script>
  <script type="text/javascript" src="dymola_interface.js"></script>
  <script type="text/javascript" src="dymola_report.js"></script>
  <script type="text/javascript"
src="http://cdn.mathjax.org/mathjax/latest/MathJax.js?config=TeX-AMS-
MML_HTMLorMML"></script>
</head>

<body>
  <h1>Dymola Report</h1>
  <p>This is a sample report to demonstrate the Dymola Report features.</p>

  <h2>Diagram</h2>
  <p>The model diagram for the Modelica.Blocks.Examples.PID_Controller is shown
below:</p>
```

```

<div id="dymola_example_diagram"></div>
<script
type="text/javascript">insertDiagram(document.getElementById("dymola_example_diagram
"), "Modelica.Blocks.Examples.PID_Controller", "svg");</script>

<h2>Plot</h2>
<p>The angular velocities of
Modelica.Mechanics.Rotational.Examples.CoupledClutches are shown below:</p>
<div id="dymola_example_plot"></div>
<script
type="text/javascript">insertPlot(document.getElementById("dymola_example_plot"),
"Modelica.Mechanics.Rotational.Examples.CoupledClutches", ["J1.w", "J2.w", "J3.w",
"J4.w"], "svg", 600, 350);</script>

<h2>Animation</h2>
<p>The animation view of
Modelica.Mechanics.MultiBody.Examples.Systems.RobotR3.fullRobot is shown below:</p>
<div id="dymola_example_animation"></div>
<script
type="text/javascript">insertAnimation(document.getElementById("dymola_example_anima
tion"), "Modelica.Mechanics.MultiBody.Examples.Systems.RobotR3.fullRobot", "xhtml",
600, 300);</script>

<div id="dymola_report_created"></div>
</body>
</html>

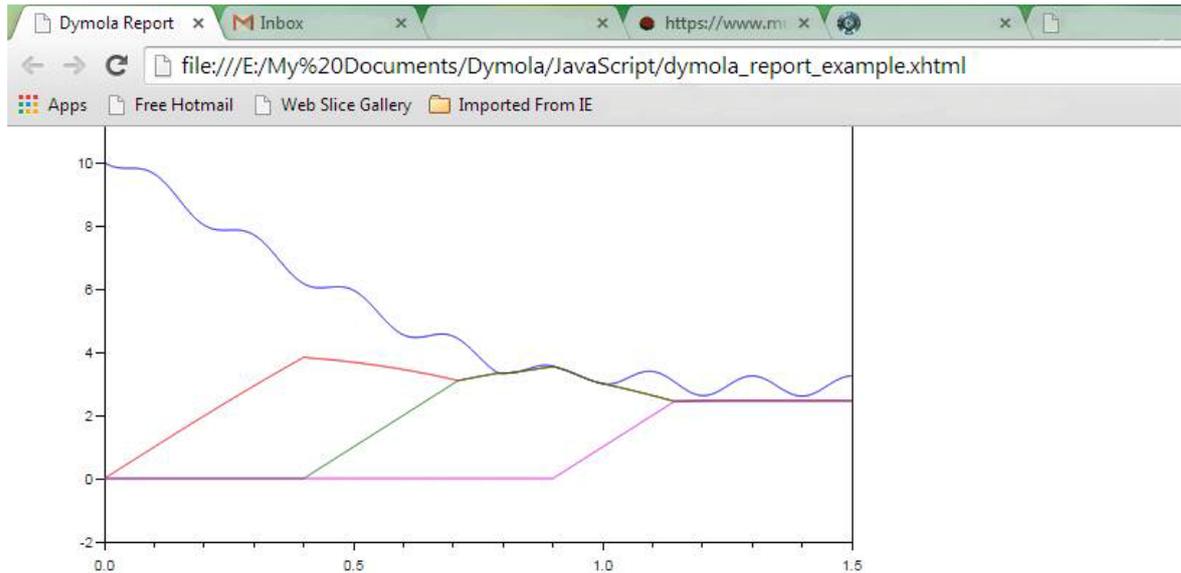
```

This example only includes a model diagram, a plot and an animation. For an example with more features, please open the file `dymola_report_example.xhtml` in the folder `Modelica\Library\javascript_interface` in the distribution (preferred browsers are Firefox or Google Chrome). Note that this file also displays the resulting report.

For more information about the report generator, open, with your favorite browser, the file `global.html`, located in

Program Files (x86)\Dymola 2015 FD01\Modelica\Library\
java_interface\doc_report

An example of how a report could look like when generated is:



Variable Value

The value of J1.w in Modelica.Mechanics.Rotational.Examples.CoupledClutches at time 0.21 is 7.94091.

Signal Operators

The model Modelica.Mechanics.Rotational.Examples.CoupledClutches has been simulated from 0 to 1.5 s. Max for J1.a is 10 and min is -19.8244.

Animation

The animation view of Modelica.Mechanics.MultiBody.Examples.Systems.RobotR3.fullRobot is shown below:



Successfully created Dymola report on Mon Sep 15 2014 09:59:12 GMT+0200 (Romance Daylight Time)



Mouse and keyboard commands available for animation in reports

The implementation of X3DOM for animation in reports provides some generic interaction and navigation methods. Navigation is controlled by specific predefined modes.

Examine mode (activate with key “e”)

Function	Button
Rotate	Left Button / Left Button + Shift
Pan	Mid Button / Left Button + Ctrl
Zoom	Right Button / Wheel / Left Button + Alt
Set center of rotation	Left Button double-click

Walk mode (activate with key “w”)

Function	Button
Move forward	Left Button
Move backward	Right Button

Fly mode (activate with key “f”)

Function	Button
Move forward	Left Button
Move backward	Right Button

Look at mode (activate with key “l”)

Function	Button
Move closer	Left Button
Move back	Right Button

Non-interactive movement

Function	Button
Reset view	R
Show all	A
Upright	U

3.5.5 FMI Support in Dymola

Unless otherwise stated, features are available both for FMI version 1.0 and version 2.0.

Support for FMI 2.0

Dymola 2015 FD01 supports FMI 2.0. For details about FMI 2.0, see the FMI 2.0 specifications, available using **Help > Documentation**

Improved handling of external resources for FMU export

On Windows

On Windows the handling of external resources is now also supported for FMI 2.0. (It was previously already supported for FMI 1.0.)

On Linux

On Linux the handling of external resources is now supported both for FMI 1.0 and 2.0.

All Dymola solvers supported for FMU Co-simulation export for FMI 2.0 on Windows

On Windows FMU export with Dymola solvers is supported also for FMI 2.0. (It was previously already supported for FMI 1.0.)

Support for Dymola license options and FMU Export options in FMI 2.0

Support for Dymola license options in FMI 2.0

The following export options are supported:

Export options	Model Exchange	Co-simulation using Ccode	Co-simulation using Dymola solvers
Binary Export	Yes	Yes	Yes
Source code export	Yes	Yes	No

Support for optional FMI Export options in FMI 2.0

The following tables list Dymola support for optional export options in FMI 2.0. Since both “True” and “False” can be a limitation, the cells are color coded: green means “underlying feature supported in Dymola”, yellow means “underlying feature not supported in Dymola”. Furthermore, capital letters are used for “underlying feature supported”.

The order of the features is the order they appear in the specification.

Optional FMI 2.0 features	Model Exchange	Model Exchange with inline integration	Co-simulation using Cvode	Co-simulation with inline integration	Co-simulation using Dymola solvers
needsExecutionTool	FALSE	FALSE	FALSE	FALSE	FALSE
completedIntegratorStepNotNeeded	false	false	NA	NA	NA
canBeInstantiatedOnlyOncePerProcess	true	true	true	true	true
canNotUseMemoryManagementFunctions	FALSE	FALSE	FALSE	FALSE	true
canGetAndSetFMUState	TRUE	TRUE	TRUE	TRUE	false
canSerializeFMUState	false	false	false	false	false
providesDirectionalDerivative	TRUE	TRUE	TRUE	TRUE	false
canHandleVariableCommunicationStepSize	NA	NA	TRUE	false	TRUE
canInterpolateInputs	NA	NA	TRUE	false	false
maxOutputDerivativeOrder	NA	NA	1	0	0
canRunAsynchronously	NA	NA	false	false	false

Support for Dymola license options and FMI Export options in FMI 1.0

Support for Dymola license options in FMI 1.0

The following export options are supported:

Export options	Model Exchange	Co-simulation using Ccode	Co-simulation using Dymola solvers
Binary Export	Yes	Yes	Yes
Source code export	Yes	Yes	No

Support for optional FMI Export options in FMI 1.0

The following tables list Dymola support for optional export options in FMI 1.0. Since both “Yes” and “No” can be a limitation, the cells are color coded: green means “underlying feature supported in Dymola”, yellow means “underlying feature not supported in Dymola”. Furthermore, capital letters are used for “underlying feature supported”.

The order of the features is the order they appear in the specification.

Optional FMI 1.0 Co-simulation features	Co-simulation using Ccode	Co-simulation with inline integration	Co-simulation using Dymola solvers
canHandleVariableCommunicationStepSize	YES	false	YES
canHandleEvents	YES	YES	YES
canRejectSteps	false	false	false
canInterpolateInputs	YES	false	false
maxOutputDerivativeOrder	1	0	0
canRunAsynchronously	false	false	false
canSignalEvents	false	false	false
canBeInstantiatedOnlyOncePerProcess	true	true	true
canNotUseMemoryManagementFunctions	FALSE	FALSE	true

Improved import of FMUs with many inputs/outputs

The import of FMUs with many inputs/outputs has been further improved; now the connectors of the same parent component are automatically stacked when imported, if there are 10 (default) or more connectors.

This number can be changed by changing the value of the flag

```
Advanced.FMI.OverlappingIOThreshold
```

The default value of the flag is 10.

The connection of stacked connectors has also been improved, see section “Extended connection dialog” on page 9.

64-bit export/import of FMUs on Linux

Dymola 2015 FD01 supports 64-bit export and import of FMUs on Linux.

Note that for the 64-bit version of Dymola, it is required to set the flag `Advanced.CompileWith64=2` when compiling applications (`dymosim.exe`) that contains imported 64-bit FMUs.

FMU Export of Simulink Models

The package `rtwscnfm` for FMU export of Simulink models has not been updated to support FMI version 2.0.

This package only supports FMI version 1.0 Model Exchange, and the package may be removed in a future release of Dymola.

3.6 Advanced Modelica Support

3.6.1 Flexible array sizes and resizing of arrays in functions

Dymola now fully supports functions with variable sized arrays (declared using `[:]`) in compiled functions, described in section 12.4.5 in Modelica Language Specification, Version 3.3., Revision 1.

Note that changing the size of such arrays uses more memory and time.

For efficiency a hint is to first assign `zeros(maxSize)` to the array, assign elements using an auxiliary size-indicator, and then shrink the array at the end to the auxiliary size-indicator.

As example, consider the following function:

```

function
...
protected Real x[:];
algorithm
  for i in 1:n
    if (...) then
      x:=cat(1,x,{f(i)});
    end if;
  end ..;

```

This function can be rewritten, to be more efficient, as (changes in italics):

```

function
...
protected Real x[:];
Integer x_size;
algorithm
  x:=zeros(n);
  x_size:=0;
  for i in 1:n
    if (...) then
      x_size:=x_size+1;
      x[x_size]:=f(i);
    end if;
  end for ..;
  x:=x[1:x_size];

```

Note that dynamic sizing of arrays in models is not supported.

3.7 Updated libraries

Below is a short description of updated libraries. For a full description, please refer to the libraries documentation.

3.7.1 Air Conditioning Library

A new version 1.9 of the Air Conditioning Library is available. Some improvements:

- Improved robustness for the refrigerant CO2 (R744) at the critical point.
- A refrigerant flow source (Reservoirs.FlowSourceCharge) is introduced as an optional component in the liquid receiver model. This makes it more convenient to reach steady-state operating points in charge experiments, since the additional refrigerant is usually stored there and does not have to travel through the system.
- Chens correlation for evaporative heat transfer is added. It is not dependent on the heat flux and therefore avoids this iterative loop in the non-linear equation systems. On the other hand it is known to be a little less accurate than other correlations
- The parameter *p_ambient*, which is used in all air models, is propagated to the top level of all heat exchangers. For numerical and efficiency reason this property is constant and not the time-varying downstream pressure. Making this parameter

available at the component tops level makes it easier to simulate pressure levels different to the atmospheric pressure. The default behavior of the models is not influenced by this change.

- Stability state as advanced feature included in refrigerant channel models. The variable `twoPhaseFraction`, which describes the fraction of a volume covered by two-phase fluid, is turned into an additional state with an artificial delay. This can in some cases avoid oscillations, which may occur for the hard-coupled dependency of the heat transfer coefficient on the amount of evaporated or condensed refrigerant in the volume. Note that activating this advanced feature may change the overall dynamic behavior of the component. The default behavior of the affected components is not influenced.

A conversion script is necessary (opens automatically) for used evaporation heat transfer correlations, see note below.

3.7.2 DataFiles Library

A minor version 1.0.2 has been released.

3.7.3 Dymola Commands Library

A major version 1.1 has been released. For changes and improvements, see section “The library `DymolaCommands` reviewed and updated, and automatically opened” starting on page 20.

3.7.4 Electric Power Library

Version 2.2 of Electric Power library contains a number of improvements. Some examples:

TurboGroups package replaces Mechanics package

The package `Mechanics` has been replaced with a `TurboGroups` package. The reason for the new package is that the `Mechanics` package was dedicated to construction of turbo groups (turbines including a generator rotor) The Turbo groups are however used in all 3-phase representations. This change should motivate the user to use dedicated mechanic libraries for mechanics modeling.

The new `TurboGroups` package has the following structure:

- Actuators: Components used in experiments, e.g. tabular torque sources. No equivalents are available in MSL (`ModelicaStandardLibrary`).
- Gears: The gear components are of a specialized type, and cannot be replaced by the MSL gear components.
- Shafts:
 - `ShaftNoMass` is modelled as a spring, it now extends its MSL equivalent `Modelica.Mechanics.Rotational.Components.Spring`.
 - `Shaft` is modeled as an inertia connected to a spring. It is built up using MSL components.

- Rotors: Two rotor types are available, one corresponding to an inertia, and one including connectors to generator rotor, stator and friction.
- Examples: Examples of turbo groups. Data records are included in the package.

Components that had equivalent components in Modelica Standard Library have been replaced with those MSL components.

Flanges are named according to the standard in Modelica Standard Library.

The Mechanics.Translation package is now obsolete and will be removed in next release.

Enumerations extensively applied

The old integer versions of SourceType, IniType etc., have been replaced by enumerations.

A conversion script is needed for conversion.

3.7.5 Engine Dynamics Library

Version 1.2.2 is a minor update of the Engine Dynamics Library. Examples of improvements:

- The simplified heat exchanger components based on efficiency (table based and eps-NTU models) have been improved in that the maximum transferable heat is now correctly computed from the enthalpy difference and flow rates of both sides. Previously this assumed uniform specific heat capacity which in rare cases could result in non-physical solutions.
- All user calibration factors for heat transfer and pressure drop has been converted from parameters to inputs. Users may still assign them with fixed values in the parameter dialog, but can now also use variable expressions to define calibration factors.
- Improved flexibility of discretized pipe models. The component can now be configured to expose a flow or control volume behavior at the component boundaries.

Automatic conversion from Engine Dynamics library 1.2.1 is supported using the included conversion script.

3.7.6 Fuel Cell Library

Version 1.3 is a major update of the Fuel Cell Library with new manifold structure for modeling of complex stack configurations and new system example. In addition, improvements of simulation speed and documentation has been made.

Major improvements:

- New manifold structure with support for both external and internal manifolds. Predefined manifolds with inlet/outlet at the top, bottom or in the middle of the stack.
- Updated FullStack template to make use of the new manifold structure. The manifold structure allows for modeling of different flow configurations: U-flow, Z-flow, Mid-flow, equally distributed flows or combinations.
- Support for both co-flow and counter flow in FullStack template

- Support for stack insulation in FullStack template
- New example: SOFC system with energy recovery (micro-gas turbine)
- SOFC system examples now use FastMedia with linear cp instead of NASA media to avoid nonlinear systems of equations and improve simulation speed.
- Added new predefined media: steam (H₂O) hydrogen mixture both as ideal gas (in NASA and Fast representation) and as ideal gas with condensated mass fraction of water.
- Added pump model
- Removed SimpleManifold as a consequence of the new manifold structure. Replaced by the new external manifold.
- Added parameter frictionDistribution to ReactionChannel. The option can be used to control the type of model exposed in the fluid connector and facilitates creation of numerically sound system models with alternating control volume and flow resistance models.

3.7.7 Heat Exchanger Library

The Heat Exchanger library version 1.2 includes a number of new features and improvements.

New features

- Added support for moist air and condensation on the ambient side of the heat exchanger
- Added an optional, more detailed representation of the air side pressure drop and heat transfer. This option is selectable from the heat exchanger parameter dialog, and is optimized for simulation of stand-alone heat exchangers with high resolution gridded boundary conditions. The original implementation is also available and is recommended for use in heat exchanger stack models.
- Added the possibility of computing the total internal liquid or working fluid volume and mass. When included in a system model based on the Liquid Cooling Library or Vapor Cycle Library, the total properties will be computed for the whole system including the heat exchanger.

Examples of improvements

- All user calibration factors for heat transfer and pressure drop has been converted from parameters to inputs. Users may still assign them with fixed values in the parameter dialog, but can now also use variable expressions to define calibration factors.
- Improved in library documentation.

Automatic conversion of user libraries is supported using the included conversion script.

3.7.8 Hydraulics Library

Hydraulics 4.1 is a major release with the following enhancements compared to 4.0. Examples of enhancements and improvements:

- The documentation is now improved throughout the library.
 - The information section (Hydraulics.Information) has been updated.
 - Each main-component have detailed documentation of usage, assumptions and extending classes.
 - The information section for the templates (see e.g. Templates.TwoPort), displays what kind of equations that has to added to classes using this template.
- The package structure is improved throughout the library. Examples:
 - A separate icons package (Utilities.Icons) is created with the most common Hydraulics Library Icons.
 - Mechanical components and actuators are now located in the Utilities.Mechanics.
 - The Visualizer package is located in Utilities.Visualizers.
 - Many of the component and example names were abbreviations. Most of the names are now changed to the full name.
 - Many components were old and deprecated. They are now placed in the package Utilities.Deprecated and will be removed after a year from the release when they were put in the deprecated package. These components are marked with a red cross and if they are used, a warning message will appear in the message log. If the user wants to keep using the component, it has to be copied to the local library. But they will no longer be supported by Modelon.
 - Basic components now have a different look. A grey thick dashed line is placed around the components, to easily identify basic components.
 - Pump and motor components are now merged and put into a new package: RotaryActuators.
 - The new component RotaryActuator represents the following pump components: SimplePump, VariablePump, TabularPump and PumpWithLoss the following motor components: SimpleMotor and VariableMotor.
 - The Sources package is now cleaned up and some components are merged.
- A few new components, examples and features have been added to the library.
 - An example visualizing usage of a Modelon Base Library (MBL) Heat Exchanger, see Examples.ThermoHydraulicsGuide.HXTableEfficiency. This is possible using the new adaptor component Interfaces.ThermoFluidAdaptor.
 - An example visualizing temperature rise in a closed system due to pump losses, see Examples.ThermoHydraulicsGuide.ClosedPumpCircuit.

- All two-port components with volumes now have conditional conductance if using thermal hydraulics.
- The component `Valves.SpoolValve` and `RotaryActuators.CentrifugalPump` now also exists as a main component and not just as a basic equivalent.
- Excavator and `LoadSensingControlSystem` are cleaned up and now easier to overview.
- The tabular oil has different extrapolation options, for instance "hold last point" and "extrapolate linearly between two last points".
- Aggregated mass and volume are now calculated within the oil component. Using the parameter "include_in_aggregate", the user can simply include or exclude a volume or chamber from the aggregated mass/volume.

Conversion scripts will only support conversion from the previous release to the current release. **Note** that the conversion script cannot handle some of the bug fixes. See the release notes in the library for more information.

3.7.9 Hydro Power Library

A minor release 2.4.1 is available. The focus is on improving the Modelica compliance and remove tool dependent implementations. As an example, all models now pass Dymola 2015 FD01 Modelica Pedantic check.

Models using Hydro Power version 2.4 will automatically be converted to version 2.4.1 when loaded into Dymola.

3.7.10 Liquid Cooling Library

Liquid Cooling library version 1.3 contains a number of new features and improvements.

New features

- New component models with geometry based pressure drop correlations.
- Added heat exchanger stack templates with 7 and 8 included heat exchangers.

Example of Improvements

- The simplified heat exchanger components based on efficiency (table based and eps-NTU models) have been improved in that the maximum transferable heat is now correctly computed from the enthalpy difference and flow rates of both sides. Previously this assumed uniform specific heat capacity which in rare cases could result in non-physical solutions.
- All user calibration factors for heat transfer and pressure drop has been converted from parameters to inputs. Users may still assign them with fixed values in the parameter dialog, but can now also use variable expressions to define calibration factors.
- Improved flexibility of discretized pipe models. The component can now be configured to expose a flow or control volume behavior at the component boundaries.

- Table based heat exchangers can now be configured to use table data from file directly from the parameter dialog.
- The aggregate volume base classes have been moved to the Modelon Base Library to allow computation of total liquid volume when the system includes components from other libraries.

Automatic conversion of user libraries is supported using the included conversion script.

3.7.11 Model Management Library

A minor release 1.1.3 of the Model Management library is now available.

3.7.12 Modelica_LinearSystems2 Library

A minor release 2.3.2 of the Modelica_LinearSystems2 library is now available.

3.7.13 Pneumatics Library

A new version 1.6.3 of the Pneumatics library is now available. Examples of improvements:

- The packages throughout the library are rearranged and restructured. Some packages are located inside Utilities and some top level packages are separated into two.
- The library has a new top level icon.
- Environment now have a new icon, displaying both pressure and temperature.
- Aggregated mass and volume are now calculated within the environment component. Using the parameter "include_in_aggregate", the user can simply include or exclude a volume or chamber from the aggregated mass/volume.
- Some components were old and deprecated. They are now placed in the package Utilities.Deprecated and will be removed after a year from the release when they were put in the deprecated package. These components are marked with a red cross and if they are used, a warning message will appear in the message log. If the user wants to keep using the component, it has to be copied to the local library. But they will no longer be supported by Modelon.

3.7.14 PowerTrain Library

The version 2.3.0 of Power Train has been released; in this version heat ports are used in all electric drives and all shafts.

The version 2.3.0 is backward compatible to all 2.x.y versions.

3.7.15 Thermal Power Library

Thermal Power version 1.9 is a major release with a number of additions and improvements. Some examples:

- New system component System_TPL. It's used to set global system settings such as T_ambient. It also automatically sums up volumes, energy and mass in twophaseMedia components and energy and mass in wall models.

- New pre heater model, `ThermalPower.TwoPhase.Condensers.Condenser_3_zones`. The 3-zones make it possible to simulate sub-cool and super-heat effects.
- New parameter in Benson separator that specifies the outlet vapor quality.
- Fixed mass conservation in `ThermalPower.TwoPhase.FlowChannels.Pipe_lumpedP` (valid for positive flow), the conservation laws were not fulfilled during transients. Note that there might be a minor difference in dynamics compared to result using older versions.
- More efficient implementation of two-phase lumped pipe, better simulation performance.
- More efficient implementation of gas lumped pipe, better simulation performance.
- Improved Modelica compliance.

Models using Thermal Power version 1.8 will automatically be converted to version 1.9 when loaded in Dymola.

3.7.16 Vapor Cycle Library

A new version 1.2 of the Vapor Cycle Library is available.

New features

- A static reversible valve, which can be used in architectures that change operation mode.
- A turbine model parametrized with a mass flow lookup table and an efficiency look up table.
- A compressor model with a parametrisation suitable for dynamic compressors. It is parametrised with an isentropic efficiency table and a mass flow table.
- An ORC example experiment has been added to the library
- A bend component has been added to the library.
- A counterflow internal heat exchanger has been added to the library.
- Visualizers for all working fluids have been added to the library.
- The library contains a new User's Guide and two Tutorials.

Examples of improvements

- Turbine or the compressor face correct inlet density also for two-phase inlet now. The default characteristics however do not take into account performance deterioration because of liquid at the inlet.
- All heat transfer correlations and pressure drop correlations for pipes have been moved in order to improve user friendliness when working with a combination of different Modelon libraries. Their description and information is updated. Running the included conversion script is necessary for this update.
- The default two phase medium model has been changed from R134a, reference properties by Tillner-Roth to R134a, short form Helmholtz EOS by Span. Its accuracy is slightly lower but still more than sufficient for most applications. The simulation speed is increased significantly with the simpler model.

- Both the receiver and accumulator can be initialized using a liquid level.
- Adding specific interfaces to the heat exchanger models increased replaceability and reusability of the models in a system context.
- The default air model is replaced with one, which is better suited for challenging steady-state initialization. Basically the same assumptions apply except that the new model neglects the liquid volume in case liquid water droplets are transported by the air stream and assumes that they do not influence the specific heat capacity. The previously used model can still be selected from a drop-down list.
- The medium model for CO2 has an improved robustness around the critical point.

Existing models can be converted to this version using the supplied conversion script.

3.7.17 Vehicle Dynamics Library

A new version 2.0 of the Vehicle Dynamics Library is available.

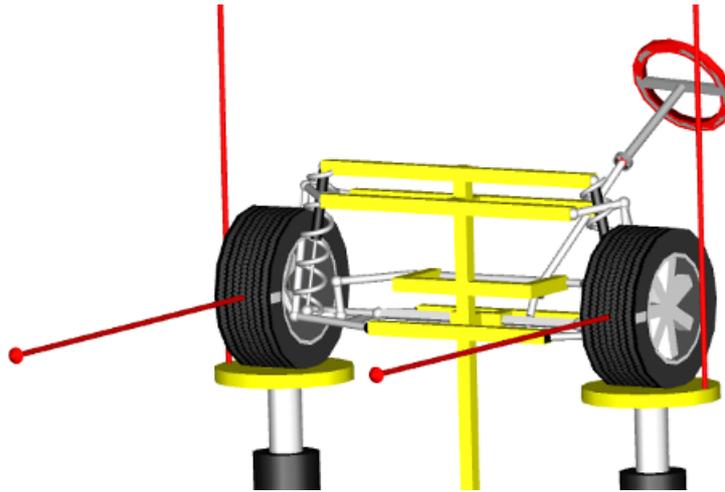
New features

Pacejka '94 Tire Contact Force Model

Support for the Pacejka '94 'Magic Formula' contact force model has been added. The Pacejka '94 contact force model provides the benefit that it requires fewer coefficients than newer models; is more commonly used than the Pacejka '02 model; and is used in many other vehicle dynamics software products. By supporting this contact force model natively in VDL, the Pacejka '94 tire coefficients can be shared between VDL and other simulation tools.

Suspension Wheel Test Rig

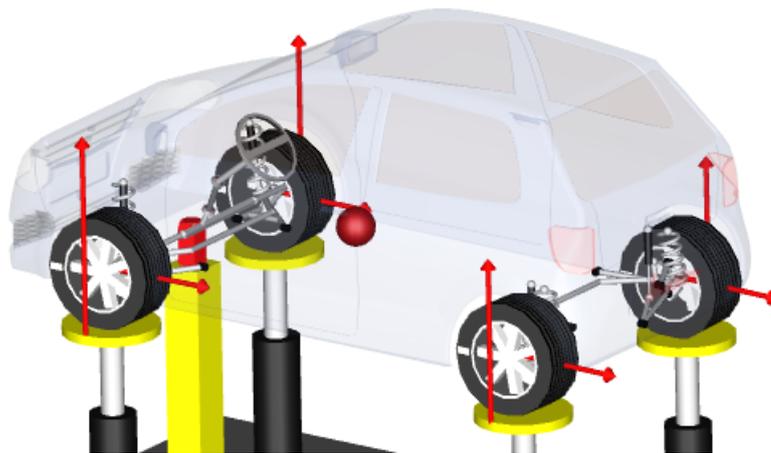
A new live tire suspension test rig has been added that allows the application of external forces and torques at either the contact patch or wheel center/hub. In physical kinematics and compliance tests, it is quite common to have a wheel and tire mounted on the suspension. It is the intent of this new rig to be able to better mimic the actual physical tests.



Example suspension experiments using this new rig can be found in: [Examples.WheelRig](#).

Chassis Kinematics & Compliance Experiments

Two new chassis-level kinematics and compliance experiments have been added: `FourPostNoWheels` & `KinematicsCompliance`. These rigs not only allow vertical excitation of the chassis, they also allow the application of external forces and torques at either the contact patch or wheel center/hub.



Ground Proximity Sensors

Ground proximity information is commonly required in vehicle dynamics simulations. Most commonly, this information is used in the contact calculations for wheels. Other applications include ride heights for aerodynamics calculations and ground impacts. Three new sensors have been added to report the proximity of a frame to ground:

- ClosestPoint - outputs the closest point located on the ground surface to the sensor
- ClosestPointInPlane - outputs a point located on the ground surface at the point of intersection of a plane and ground
- IntersectionAlongLine - outputs a point located on the ground surface at the point of intersection of a line and ground

Existing ground sensors that were previously located in Chassis.Sensors have been moved to Ground.Sensors. This includes the following sensors:

- FrameInPlaneThreePoints
- FrameOnGround
- GroundCurvature
- GroundHeight
- VelocityOfGround

Ride Height Dependent Aerodynamics Models

Four new aerodynamics models have been added that are dependent on front/rear ride heights. The different models demonstrate how to represent lift/drag/side aerodynamic forces using either a polynomial or tabular data:

- PitchPolynomialLD
- PitchPolynomialLDS
- PitchTabularLD
- PitchTabularLDS

Some models will automatically be converted from version 1.9 to version 2.0 when loaded.

3.8 Documentation

In the software distribution of Dymola 2015 FD01 Dymola User Manuals of version “September 2014” will be present; these manuals include all relevant features/improvements of Dymola 2015 FD01 presented in the Release notes.

A new section covering license requirements for e.g. export/import features is added in the chapter “Appendix - Installation”, in Dymola User Manual Volume 1.

3.9 Appendix – Installation: Hardware and Software Requirements

Below the current hardware and software requirements for Dymola 2015 FD01 are listed.

3.9.1 Hardware requirements/recommendations

Hardware requirements

- At least 1 GB RAM
- At least 400 MB disc space

Hardware recommendations

At present, it is recommended to have a system with an Intel Core 2 Duo processor or better, with at least 2 MB of L2 cache. Memory speed and cache size are key parameters to achieve maximum simulation performance.

A dual processor will be enough if not using multi-core support; the simulation itself, by default, uses only one execution thread so there is no need for a “quad” processor. If using multi-core support, you might want to use more processors/cores.

Memory size may be significant for translating big models and plotting large result files, but the simulation itself does not require so much memory. Recommended memory size is 2-4 GB of RAM for 32-bit architecture and 3-6 GB of RAM for 64-bit architecture.

3.9.2 Software requirements

Microsoft Windows

Dymola versions on Windows and Windows operating systems versions

Dymola 2015 FD01 is supported, as 32- and 64-bit application, on Microsoft Windows 7 and Windows 8.1. Since Dymola does not use any features supported only by specific editions of Windows (“Home”, “Professional”, “Enterprise” etc.), all such editions are supported if the main version is supported.

For users of Windows XP and Windows Vista, specific conditions apply. Please see section “Support for Windows XP and Windows Vista” on page 26.

Compilers

Please note that for the Windows platform, a Microsoft C/C++ compiler, or a GCC compiler, must be installed separately. The following compilers are supported for Dymola 2015 FD01 on Windows:

Microsoft C/C++ compilers, free editions:

- Visual Studio 2008 Express Edition (9.0)

- Visual C++ 2010 Express (10.0)
- Visual Studio 2012 Express Edition (11.0)
- Visual Studio 2013 Express Edition (12.0)

Microsoft C/C++ compilers, professional editions:

- Visual Studio 2005 (8.0)
- Visual Studio 2008 (9.0)
- Visual Studio 2010 (10.0)
- Visual Studio 2012 (11.0)
- Visual Studio 2013 (12.0)

GCC compilers

Dymola 2015 FD01 has limited support for the MinGW GCC compiler, with a GCC version compatible with 4.8. Note the present limitations, and a demand for an add-on, refer to section “GCC” on page 5.

Dymola license server

For a Dymola license server on Windows, all files needed to set up and run a Dymola license server on Windows, except the license file, are available in the Dymola distribution. (This includes also the license daemon, where Dymola presently supports FLEXnet Publisher version 11.11. This version is part of the Dymola distribution.)

Linux

Supported Linux versions and compilers

Dymola 2015 FD01 runs on SUSE Linux (Release 11), 32-bit and 64-bit, with gcc version 4.3.4, and compatible systems. In addition to gcc, the model C code generated by Dymola can also be compiled by clang. To change compiler, change the variable `CC` in `/opt/dymola-<version>-<architecture>/insert/dsbuild.sh`, where `<architecture>` is `i586` for 32-bit application, and `x86_64` for 64-bit application. As an example, for a 64-bit Dymola 2015 FD01 application:

```
/opt/dymola-2015FD01-x86_64/insert/dsbuild.sh
```

Dymola 2015 FD01 is supported as a 32-bit and 64-bit application on Linux.

Notes

- For rendering of jpg files, libjpeg62 must be installed.
- 32-bit compilation might require explicit installation of 32-bit libc. E.g. on Ubuntu:

```
sudo apt-get install g++-multilib libc6-dev-386
```

Note on Optimization library

Please note that you have to use the Optimization library version 2.x or higher to use multi-criteria design optimization on Linux; the older Design.Optimization package does not support multi-criteria design optimization on Linux.

Dymola license server

For a Dymola license server on Linux, all files needed to set up and run a Dymola license server on Linux, except the license file, are available in the Dymola distribution. (This also includes the license daemon, where Dymola presently supports FLEXnet Publisher version 11.11.)