



3DEXPERIENCE®

Dymola 2017 FD01

Overview of new features

2 December 2016

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Executive Summary

Modeling and simulation

- Editor to configure variable selections, which enables smaller result files and easy plotting of key signals.
- Commands history gives better overview of previous commands and easier selection.
- Improved diagnostics more clearly identifies model translation problems.
- Sparse solver offers substantial speedup for certain kinds of models.

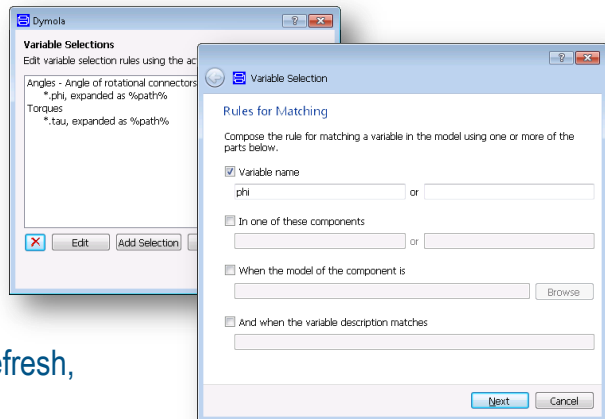
Portfolio changes and new Modelica libraries

- Model calibration, model management and real-time simulation included in standard Dymola, facilitating development of high-quality models.
- Cooling system library for quick dimensioning and lifetime/performance assessment of batteries, electric drives and electronic thermal management.
- Brushless DC Drives library facilitates effective development of drive systems.

Modeling and simulation

Model editor

- ▶ Editor to configure variable selections
 - ▷ Reduces size of simulation result file
 - ▷ Easier to find/group signals
 - ▷ Now much easier to define
- ▶ Improvements in Package browser (refresh, safeguards, quick rename, etc.)
- ▶ Improved search capability across most Dymola widgets



General improvements

- ▶ Improved commands history
 - ▷ Better overview of previous commands, direct selection possible

```

simulateModel("Modelica.Mechanics.Rotational.Examples.CoupledClutches", stopTime=1.5, numberofIntervals=0, outputInterval=0.001, method="dassi", resultFile="CoupledClutches");
plotSignalOperator("CoupledClutches[end].J1.der(phi)", SignalOperator.Max, 0, 1.5, 0, 1);
freqHz = 1;
simulateModel("Modelica.Mechanics.Rotational.Examples.CoupledClutches", stopTime=1.5, numberofIntervals=0, outputInterval=0.001, method="dassi", resultFile="CoupledClutches");
plotSignalOperator("CoupledClutches[end].J1.der(phi)", SignalOperator.ArithmeticMean, 0, 1.5, 0, 1);
plot("J1.der(phi)", colors={(28,108,200)});

plot(("*J1.der(phi)*", colors={(28,108,200)});]
  
```

- ▶ Restoring settings after restart
 - ▷ New XML format for settings, changes always saved and automatically restored
 - ▷ Import / Export of settings facilitates custom profiles

Improved diagnostics

- ▶ Model translation
 - ▷ More clearly identifies the problem
 - ▷ Fewer redundant messages
 - ▷ Clickable links into model
- ▶ Non-linear solver failure diagnostics during simulation
 - ▷ Enabled in Simulation>Setup>Debug

```

; (line 51, column 8: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
❌ Orphan expression a + 1.
  Expressions must be part of an equation, assignment or procedure call.
<assignment> (line 64, column 17: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
❌ Unexpected comma separated list of expressions (a,) in left-hand side of assignment.
  Right-hand side [1, 2] of assignment is not a function call.
  An assignment with an expression list as left-hand must have a function call as right-hand.
<assignment> (line 65, column 14: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
<equation> (line 67, column 14: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
<equation> (line 68, column 9: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
<assignment> (line 73, column 11: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
while (line 78, column 3: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
❌ while loops are prohibited in equation sections.
<equation> (line 83, column 13: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
<import> (line 89, column 11: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
❌ import in assignment prohibited.
<import> (line 91, column 11: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
<a declaration> (line 101, column 6: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
⚠️ a has as type its name (name and type are equal).
❌ x modification> (line 121, column 34: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
❌ Ambiguous modifications x="v" and x=1.
  Multiple modification of the same component is prohibited.
  It is prohibited to modify subcomponents of a final, replaceable or redeclare modified component C.
<x modification> (line 122, column 36: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
<x modification> (line 124, column 36: SyntaxErrorMessagesImprovement\_DCP\_2\_2016)
  
```

Simulation

- ▶ Support for Sundials with sparse solver
 - ▷ Substantial speedup for some kinds of models
 - ▷ Speedup factor 35 with example from Francesco Casella's scalability test suite
- ▶ Improved and extended profiling
 - ▷ Add time to calculate Analytical Jacobian
 - ▷ Smoother handling of granularity

```

model CascadedFirstOrder
  "N cascaded first order systems, approximating a pure delay"
  parameter Integer N = 2000 "Order of the system";
  parameter Modelica.SIunits Time T = 1 "System delay";
  final parameter Modelica.SIunits Time tau = T/N "Individual time constant";
  Real x[N](each start = 0, each fixed = true);
equation
  tau*der(x[1]) = 1 - x[1];
  for i in 2:N loop
    tau*der(x[i]) = x[i-1] - x[i];
  end for;
annotation (
  experiment(StopTime = 2, Tolerance = 1e-6),
  Documentation(info = "<p>This model is meant to try out the tool performance with ODE systems of possibly very large size, with high sparsity degree.</p><p>The model is a cascaded connection of first order linear systems, approximating a pure delay of <t>T</t> seconds as <t>N</t> approaches infinity. It contains exactly <t>N</t> state variables and <t>N</t> differential equations.</p></html>"));
end CascadedFirstOrder;

```

FMI and environment

- ▶ Support for input interpolation in FMU import
- ▶ FMI Kit for Simulink version 2.3.0
 - ▷ Improved input handling
 - ▷ FMU export supported also on Linux
- ▶ Possibility to stop description information from being stored in result files
- ▶ Support for new HIL platform: dSPACE MicroLabBox
- ▶ JavaScript interface supported on Linux
- ▶ Python interface compatible with Python 3
- ▶ Support for Visual Studio 2015

Portfolio changes and new Modelica libraries

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9

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Dymola product portfolio changes

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- ▶ The functionality of these products become part of the DYM-N and DYM-C configurations
 - ▷ MOC-x – Dymola Model Calibration
 - ▷ MOM-x – Dymola Model Management
 - ▷ RHS-x – Dymola Real-Time Simulation
- ▶ Dymola run-time licenses (DYR-x) removed
 - ▷ Code export using Binary Model Export (XBM) or Source Code Generation (GSC) are better alternatives because no runtime license must be managed on the target

10

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Brushless DC Drives Library

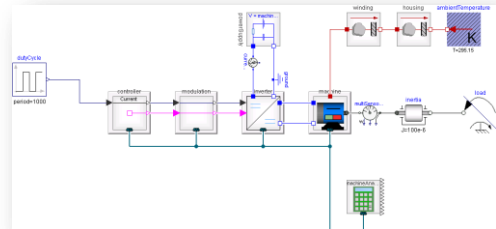
Effective development of drive systems containing brushless DC drives

► Benefits

- ▷ Wide range of scenarios with different levels of complexity
- ▷ Simple coupling with other technical domains (mechanical, thermal)
- ▷ User extension and specialization of the library possible

► Use cases

- ▷ Speed/torque controller design of powertrains
- ▷ Loss estimation of electric machine and thermal simulations
- ▷ Study the effects Voltage and current ripple effect
- ▷ Compute the system energy consumption



11

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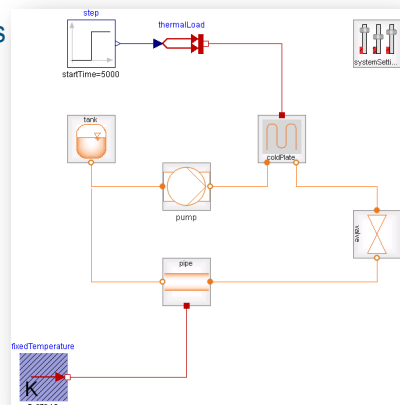
Cooling Systems Library

► Benefits

- ▷ Quickly dimension cooling components to assess sub-systems lifetime and performance
- ▷ Dedicated to batteries, electric drives and electronic thermal management
- ▷ Simplifies control development by considering thermal inertia of coolant circuit based on dynamic models

► Features

- ▷ Boundary conditions, pumps, pipes, valves, reservoirs, heat exchangers, cold plates
- ▷ Single phase cooling media with thermal dynamics properties
- ▷ High simulation performance for use cases like drive cycles
- ▷ Supports 2D temperature analysis of surfaces



12

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Wind Power Library

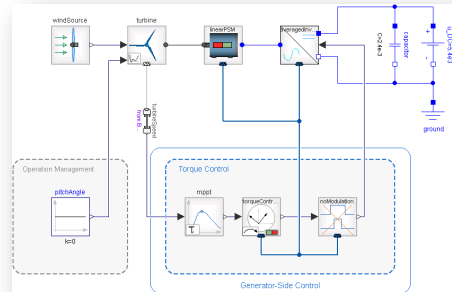
Rapidly model and simulate wind turbines for optimized performance

► Benefits

- ▷ Components for Turbines, Electric Machines and Controllers, Grid and Power Electronics
- ▷ Field-oriented control of Permanent-Magnet Synchronous Generator (PMSG)
- ▷ Voltage-oriented Control of the Grid
- ▷ Uses Electrified Powertrain Library

► Use case

- ▷ Maximum power point tracking (MPPT) techniques



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