



# 3DEXPERIENCE®

# Dymola 2019

Overview of new features

1 June 2018

## Executive Summary

### Model creation

- Easily capture parameters of existing components to create new models.
- Improved use of display units in the diagram layer and in plots reduces model ambiguity.

### Simulation

- More robust and efficient handling of models with nonlinear equation systems through improved handling of guess values and choice of extrapolation methods.
- Improved diagnostics at compilation and runtime helps find difficult numeric problems, and intermediate values can be checked during debugging.
- More efficient code generation for parameters, and eliminated code-bloat for large tables of data.

### Modelica libraries

- New Pneumatic Systems library.

# Model editing

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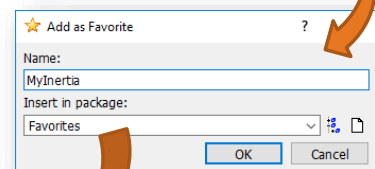
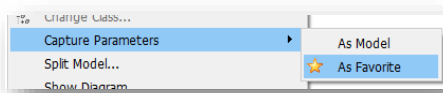
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## Capture parameters of a component

- ▶ You have a component with parameters or other modifiers such as re-declarations
- ▶ Create a new model or a favorite capturing those settings

```
model MyInertia = Modelica.Mechanics.Rotational.Components.Inertia (
  J=1,
  phi(fixed=true, start=0),
  w(start=10, fixed=true)
);
```



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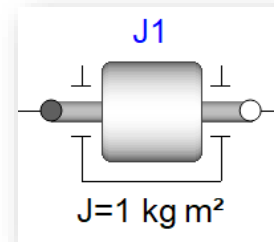
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## Display units

- ▶ Improved presentation of display units

- ▷ Diagram layer (can be disabled)
- ▷ Parameter dialog
- ▷ Plot window

— J1.J [kg · m<sup>2</sup>] — J1.flange\_b.tau [N · m] — J1.der(phi) [°/s]



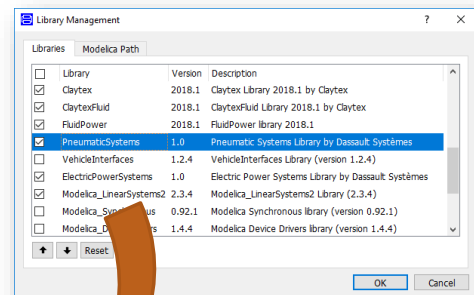
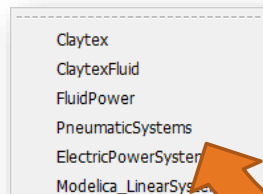
- ▶ Possible to select display unit in the variable browser

## Customizing the Libraries menu

- ▶ Select which libraries will be shown

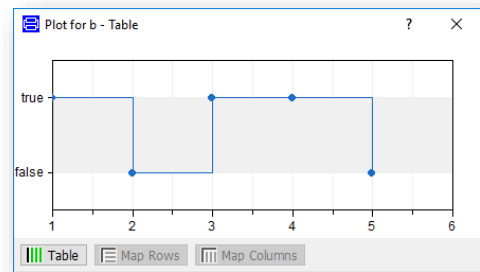
- ▷ Rather than all installed libraries

- ▶ Reorder libraries as you want them



## Other features in the graphical editor

- ▶ Filtering of inherited components in the diagram layer of editable models
- ▶ Improved plotting of Boolean and Integer arrays in the matrix editor
- ▶ Possibility to add variables to bus declarations when connecting expandable connectors



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## Simulation

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## Initial guesses for nonlinear equations

- ▶ Initial guesses are used for nonlinear systems of equations
  - ▷ To enable fast and robust solution
  - ▷ Improved in Dymola 2019
- ▶ Inter-/extrapolation method used to compute initial guesses can be controlled
  - ▷ Chose between linear or constant extrapolation
  - ▷ Advanced.Define.InitialGuessInterpolation=n
- ▶ Can force the integrator to solve nonlinear equations each integrator step
  - ▷ Updates the initial guesses more often
  - ▷ Advanced.MoveEquationsToDynamics=true

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## Improved nonlinear solver diagnostics

- ▶ Help to debug nonlinear equations
  - ▷ Equation systems appropriately named
  - ▷ Dependencies logged during translation
  - ▷ Information about common causes for failures
  - ▷ List of settings to get more information
- ▶ Nonlinear solver summary for performance estimation

```

i Variables appearing in the nonlinear systems of equations
  i System initialization.nonlinear[1]:
    i The equation system depends on the following variables:
      freeMotionScalarInit.r_rel_a_1
      freeMotionScalarInit.r_rel_a_2
    i Iteration variables:
      revolute1.phi
      revolute2.phi
  
```

```

Nonlinear solver summary, accumulated amounts:
Tag           , Calls, Residues, Iterations, Jacobians
initialization.nonlinear[1]:      1,      6,      6,      1
simulation.nonlinear[1] : 429665, 860615, 860615, 429913
simulation.nonlinear[2] : 99195, 199130, 199130, 99325
To also log used CPU-times enable Advanced.GenerateBlockTimers.
  
```

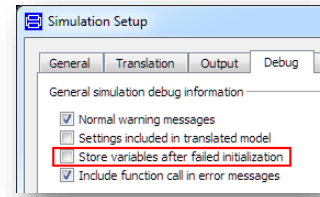
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## Values after failed initialization or simulation

- ▶ Plot variables after failed initialization or simulation
  - ▷ Intermediate values available even though a solution has not been found
  - ▷ Helps find what variables caused the problem
  - ▷ May be inconsistent, depending on how far the calculation got before aborting
- ▶ Intended as a debugging tool
  - ▷ Not enabled by default



## DAE mode for nonlinear equation systems

- ▶ May give more efficient simulation if there are many or large nonlinear equation systems
  - ▷ Fewer nonlinear equation systems are solved
  - ▷ Not a universal solution
- ▶ Must be explicitly enabled
  - ▷ `Advanced.Define.DAEsolver = true`
- ▶ Only available for certain numerical integrators
  - ▷ Dassl, Radau Ila, Emdirk23a, Emdirk34a, Emdirk45a, and Sdirk34hw

## More efficient C code generation

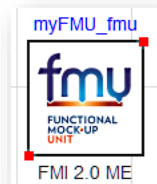
- ▶ Alias elimination for parameters reduces code size
  - ▷ Advanced.AllowParameterAlias = true
- ▶ More efficient handling of constant table data
  - ▷ Table is not allocated in result file and generated C code is reduced

```
model HideArray
  parameter Real myTable[:,2]=[linspace(0, 30, 50), sqrt(linspace(0.0, 100, 50))]
  annotation (Evaluate=true, HideArray=true);

  Modelica.Blocks.Tables.CombiTable1D combiTable1D(table=myTable) ☐;
  Modelica.Blocks.Sources.Clock clock ☐;
equation
  connect(combiTable1D.u[1], clock.y) ☐;
  annotation (__Dymola_experimentFlags(Advanced(AllowParameterAlias=true)));
end HideArray;
```

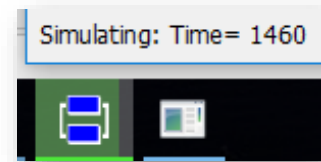
## Functional Mockup Interface

- ▶ Reorganization of simulation setup dialog for FMI
- ▶ FMU Export
  - ▷ Defining user-defined model identifiers for FMUs in GUI
  - ▷ Sparse Jacobian handling when including source code supported
  - ▷ Sparse solver support
  - ▷ Export of models in DAE mode
- ▶ FMI Kit for Simulink
  - ▷ Support for MATLAB R2017a and R2017b



## Other new features

- ▶ Plot improvements: Signal operators for curves plotted against independent variables other than time
  - ▷ For example: fuel consumption vs. distance travelled
- ▶ Taskbar icon shows approximate progress
  - ▷ Relative the simulation stop time
- ▶ Support for Visual Studio 2017 compiler

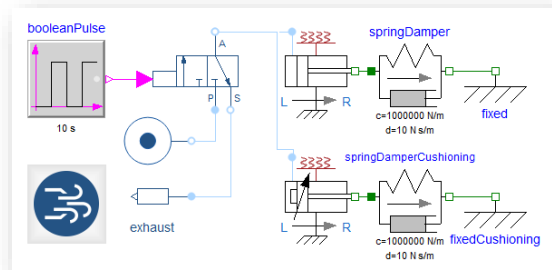


## Modelica libraries



## Pneumatic Systems Library

- ▶ Architecture design, component sizing, modelling and simulation of pneumatic systems
- ▶ Physical effects
  - ▷ Capacitance, resistance, heat transfer, power transformation
- ▶ Components
  - ▷ Valves, reservoirs, actuators, piping, sources



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## Major updates in several libraries

- ▶ Battery
- ▶ ClaRa DCS
- ▶ ClaRa Plus
- ▶ Cooling
- ▶ Electrified Powertrains
- ▶ Fluid Power
- ▶ Human Comfort
- ▶ Hydrogen
- ▶ Testing
- ▶ Thermal Systems
- ▶ VeSyMA
- ▶ VeSyMA Engines
- ▶ VeSyMA Powertrain
- ▶ VeSyMA Suspensions

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