

3DEXPERIENCE

Dymola 2013 FD01

Overview of new features

30 November 2012

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Executive Summary

Model editing and navigation

- Quick access to favorite models, create your own collection.
- Extend the user interface with custom menus and toolbars.

Simulation, plotting and post-processing

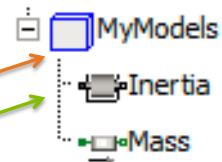
- User-defined selection of variables stored in result file reduces file size and facilitates easy access.
- Plot general expressions and perform operations on plotted signals.
- Show simulation results as a table (in addition to plotting).
- Extended post-processing with improved linear system analysis.

New model libraries

- Engine Dynamics, Liquid Cooling
- Electric Power, Hydro Power, Thermal Power.

Shortcuts to favorite models

- ▶ Modelica package with models + annotation
- ▶ Dymola inserts original model pointed to
- ▶ Possible to add modifiers (L=1)

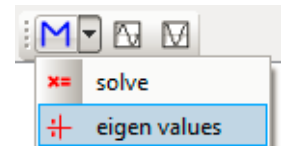
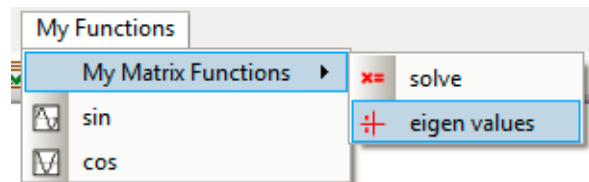


```

package MyModels
  model Inertia=Modelica.Mechanics.Rotational.Components.Inertia
    annotation (__Dymola_shortcut=true);
  model Mass=Modelica.Mechanics.Translational.Components.Mass(L=1)
    annotation (__Dymola_shortcut=true);
end MyModels;
  
```

Custom menus and toolbars

- ▶ Extend the Dymola user interface with your own menus and toolbars
- ▶ Defined by a Modelica package
 - ▷ Call any Modelica function with arguments as needed
 - ▷ Multiple levels of menus and toolbar (sub-package)
- ▶ ... and the details
 - ▷ Can be hidden from package browser
 - ▷ Persistent (survives Clear All)
 - ▷ No need to load referenced function to define menu/toolbar
 - ▶ Referenced package is opened when calling function



Example of custom menu/toolbar definition

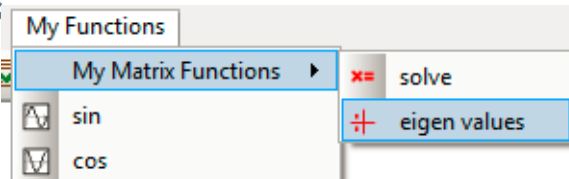
```

package MyFunctions "My Functions"
  package MyMatrixFunctions "My Matrix Functions"
    function solve=Modelica.Math.Matrices.solve(A=[1,2;3,4],b={1,1})
      annotation (Icon(graphics={...}));
    function eigenValues=Modelica.Math.Matrices.eigenValues
      "eigen values" annotation (Icon(graphics={...}));
    annotation(Icon(graphics={...}));
  end MyMatrixFunctions;

function sin=Modelica.Math.sin;
function cos=Modelica.Math.cos;

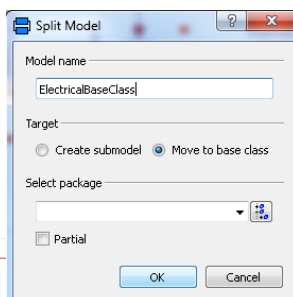
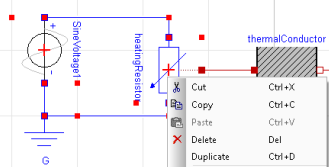
annotation(__Dymola_toolbar=true, __Dymola_menu=true,
  protection(hideFromBrowser=true));
end MyFunctions;

```

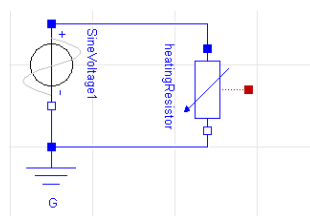


Create base class

A part of the model is selected to be moved to a base class



ElectricalBaseClass



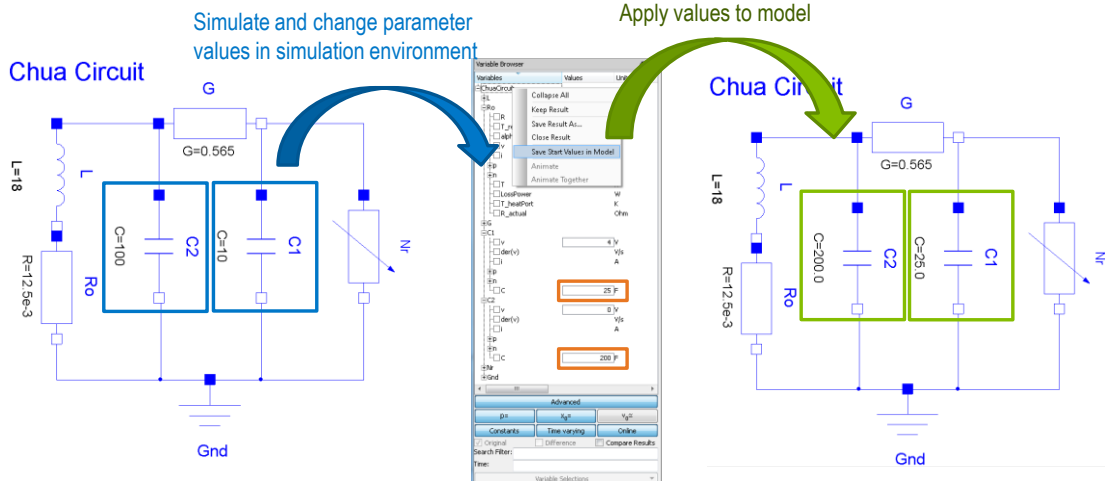
Remaining model using the base class

```

model HeatingResistor "Heating resistor"
  extends ElectricalBaseClass;
  parameter Real heatTransferCoefficient;
  Modelica.Thermal.HeatTransfer.Components.ThermalConductor thermalConductor(G=50)
  ;
  Modelica.Thermal.HeatTransfer.Celsius.FixedTemperature fixedTemperature(T=20)
  ;
equation
  connect(heatingResistor.heatPort, thermalConductor.port_a)
  ;
  connect(thermalConductor.port_b, fixedTemperature.port) ;
end HeatingResistor;

```

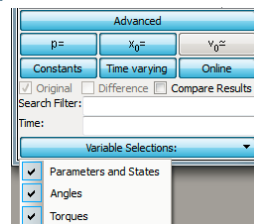
Applying simulation parameters to model



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User-defined selections of variables

- ▶ Easier to find significant variables and parameters in the simulation result
- ▶ Reduces size of result file
 - ▷ Default: store states, parameters and variables in selections
- ▶ You can have multiple selections and choose which are shown
- ▶ Based on pattern matching in
 - ▷ Variable names, name of classes to look in
 - ▷ Description string
 - ▷ Tags (user-defined annotations on variable declarations)



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Simple example of variable selections

```

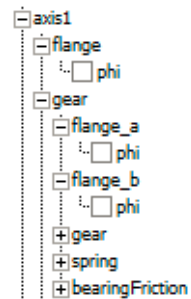
model Selection1
  annotation (__Dymola_selections={
    Selection(name="MySelection",
      match={MatchVariable(name="*.phi")})
  });
end Selection1;

```

```

model MyFullRobot
  extends Modelica.Mechanics.MultiBody.Examples.Systems.RobotR3.fullRobot;
  extends Selection1;
end MyFullRobot;

```

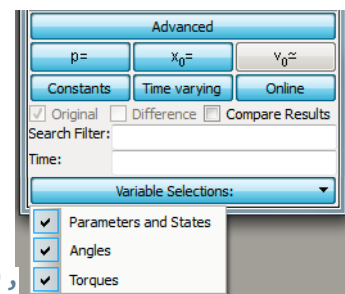


Selections in the variable browser

```

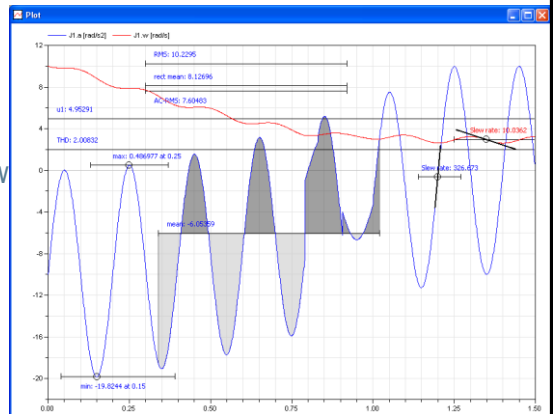
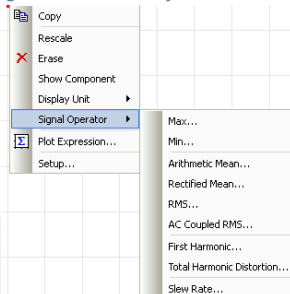
model Selection7
  annotation (__Dymola_selections={
    Selection(name="Angles",
      match={MatchVariable(name="*.phi",
        newName="%path%")}),
    Selection(name="Torques",
      match={MatchVariable(name="*.tau",
        newName="%path%")})
  });
end Selection7;

```



Operators on signals

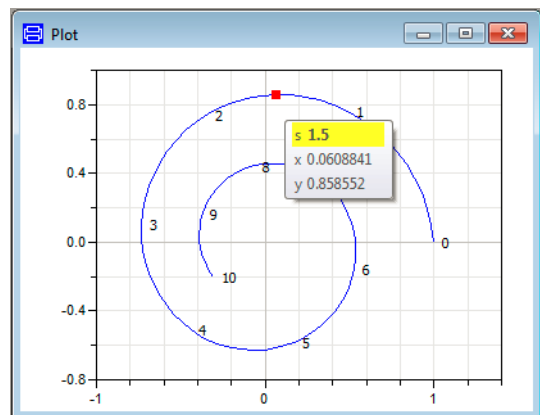
- ▶ Apply operators to signals in the plot window
 - ▷ Min, max, mean, RMS, THD, ...
- ▶ Value can be copied
- ▶ Define time range (default entire simulation)
 - ▷ Can be changed interactively
- ▶ Scriptable



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Plot parametric curve



```
s=0:0.1:10
```

```
y={sin(t)*exp(-0.1*t) for t in s}
```

```
x={cos(t)*exp(-0.1*t) for t in s}
```

```
plotParametricCurve(x, y, s , labelWithS=true);
```

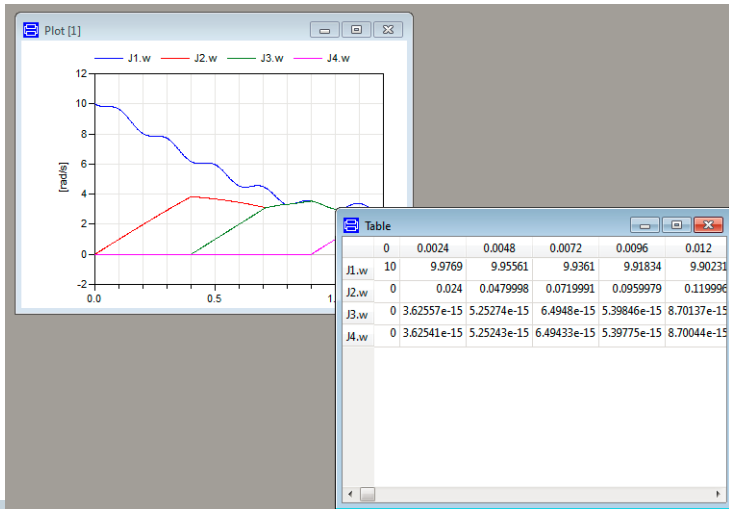
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Show simulation results as a table

Plot > New Window > New Table Window

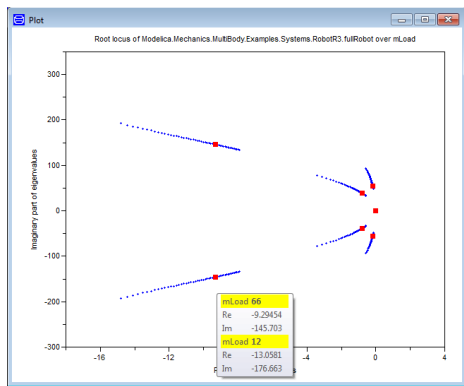
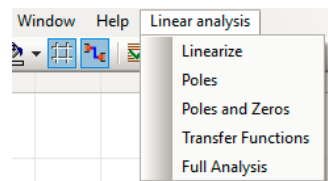


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Linear systems analysis

Easily reachable from the Linear Systems toolbar

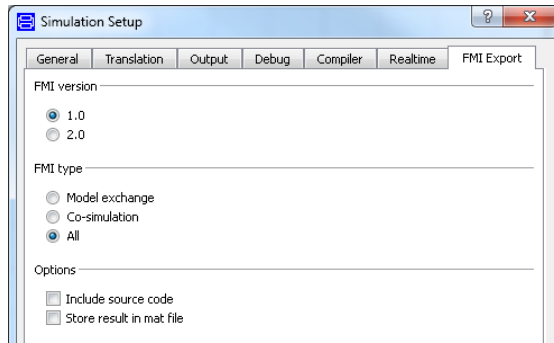
- ▶ Based on Linear_Systems2
- ▶ Improvements in 2013 FD01
 - ▷ Functionality
 - ▷ Documentation
 - ▷ Ergonomics – easily reachable from the Dymola menu



FMI 2.0 Beta 4 support (LA)

2.0 final not yet released – expected before end of the year

- ▶ Model exchange
 - ▷ Import
 - ▷ Export
- ▶ Co-simulation
 - ▷ Import
 - ▷ Export
- ▶ 32 & 64 bit support
- ▶ Export as binary or source code
- ▶ FMI 1.0 support for back-compatibility

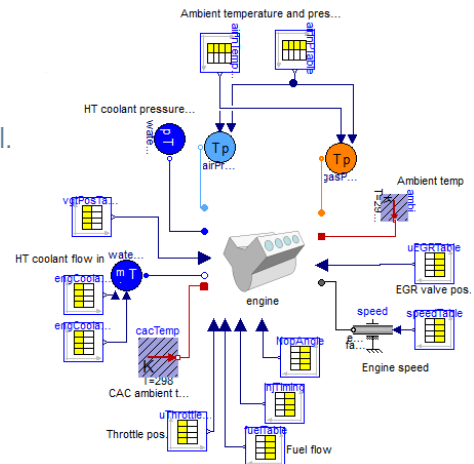


New model libraries

Engine Dynamics Library

Modelon

- ▶ Combustion engine system modeling, simulation and analysis, including the complete gas exchange.
- ▶ Transient engine response and related engine control.
- ▶ Control design with the purpose
 - ▷ Reducing emission transients from the engine
 - ▷ Transient exhaust condition modeling for optimum EATS operation conditions
 - ▷ Engine response dynamics.
- ▶ Uses a mean value combustion model for torque, charge flow and exhaust condition modeling.



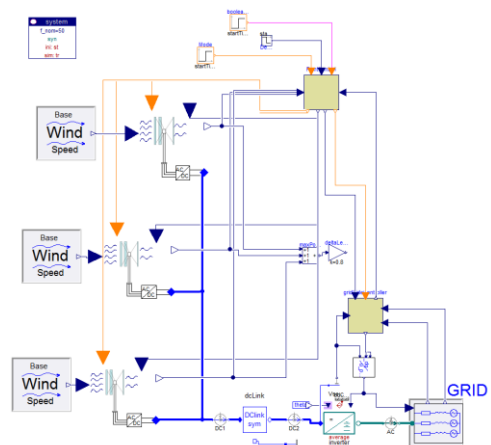
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Electric Power Library

Modelon

- ▶ Modeling, simulation and analysis of electric power systems
- ▶ Both steady state and transient operation
- ▶ Model the complete power plant
 - ▷ From the energy source (oil, gas, hydropower or other renewable energy such as wind)
 - ▷ Through generator and power grid
 - ▷ To the end consumer.

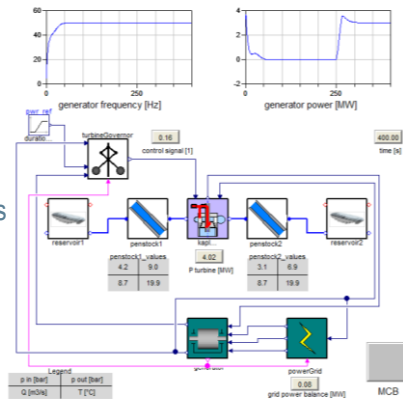


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Hydro Power Library

- ▶ Modeling and simulation of hydropower plant operation
 - ▷ Performance analysis and optimization of the operation
 - ▷ Power plants with multiple reservoirs and multiple turbines
 - ▷ ... in order to maximize the overall efficiency
- ▶ Suitable for simulation of transient operation
- ▶ Study control strategies to cope with the rapid load changes
 - ▷ More frequent as other renewable, less controllable, sources of energy are increasingly used
- ▶ Planning of commissioning tests and procedures
 - ▷ Reducing the risk of unexpected events
 - ▷ Minimizing costly tests done on the actual plant



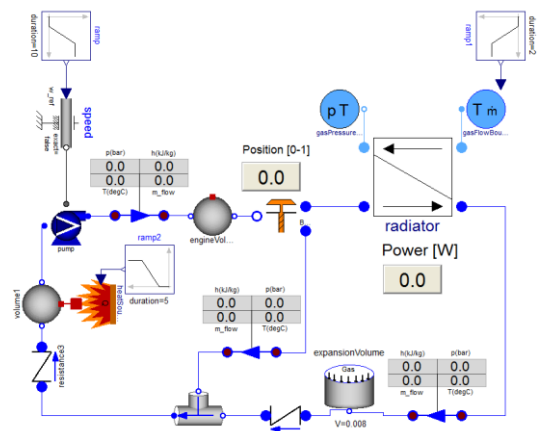
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Liquid Cooling Library

- ▶ Liquid cooling system design
- ▶ Compressible or incompressible flow
- ▶ Applications include
 - ▷ Engine cooling
 - ▷ Battery thermal management
 - ▷ Cooling of power electronics and machines
- ▶ Multiple industries
 - ▷ Automotive
 - ▷ Industrial equipment
 - ▷ Process industry



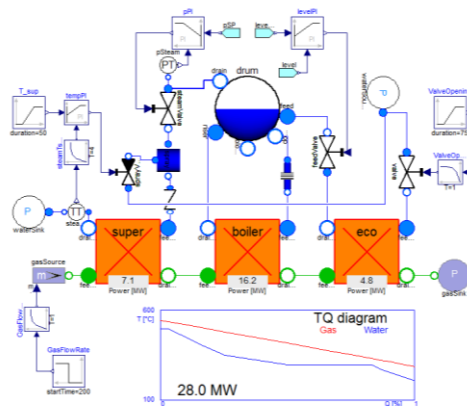
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Thermal Power Library

- ▶ Modeling of thermal power plant operation including transient operation
- ▶ Dynamic as well as steady-state behavior using the same model
- ▶ Covers
 - ▷ Entire steam cycle
 - ▷ Flue gas side
 - ▷ Combustion models



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Libraries by industry

A comprehensive set of libraries for all industries

- ▶ Automotive
 - ▷ Power Train
 - ▷ Smart Electric Drives
 - ▷ Flexible Bodies
 - ▷ Vehicle Dynamics
 - ▷ Air Conditioning
 - ▷ Engine Dynamics
 - ▷ Liquid Cooling
 - ▷ Hydraulics
 - ▷ Pneumatics
- ▶ Energy
 - ▷ Electric Power
 - ▷ Hydro Power
 - ▷ Thermal Power
- ▶ Aerospace
 - ▷ Air Conditioning
 - ▷ Hydraulics
 - ▷ Pneumatics
 - ▷ Liquid Cooling
 - ▷ Smart Electric Drives
 - ▷ Flexible Bodies
- ▶ Industrial Equipment
 - ▷ Hydraulics
 - ▷ Pneumatics
 - ▷ Liquid Cooling
 - ▷ Smart Electric Drives
 - ▷ Flexible Bodies

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