

3DS.COM | © Dassault Systemes | Confidential Information | 2017-05-31 | ref.: 3DS_Document_2015



Dymola 2018

Overview of new features

2 June 2017

3DEXPERIENCE®

Executive Summary

Modeling and simulation

- Support for creating template models from existing models. Such refactoring of models is facilitated by Dymola suggesting suitable base classes and replaceable components.
- Enhancement to analyze the interaction between models and the numeric integration, helping the user to improve models for more efficient simulation and to tune the numeric integration.
- To improve simulation performance, support for sparse numeric solvers has been extended. Inline implicit solvers have been implemented for predictable real-time behavior of embedded code.

New Modelica libraries

- Thermal Systems Library
- Vehicle Systems Modeling and Analysis (VeSyMA) Library
- Vehicle Systems Modeling and Analysis (VeSyMA) – Powertrain Library
- Vehicle Systems Modeling and Analysis (VeSyMA) – Suspensions Library

Model development

- ▶ Support for building template models
 - ▷ User-friendly bottom-up method
 - ▷ Start with a test model and refactor afterwards
 - ▷ Dymola helps to suggest base class and make components replaceable
- ▶ Support for Modelica language 3.4
 - ▷ Modelica 2.x no longer supported, automatic conversion of graphical annotations to 3.x

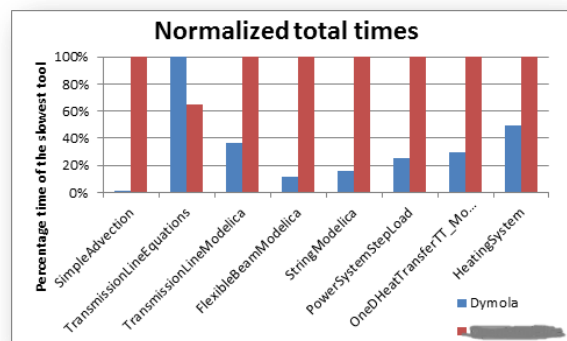
Original model

Refactoring

Template +
New model

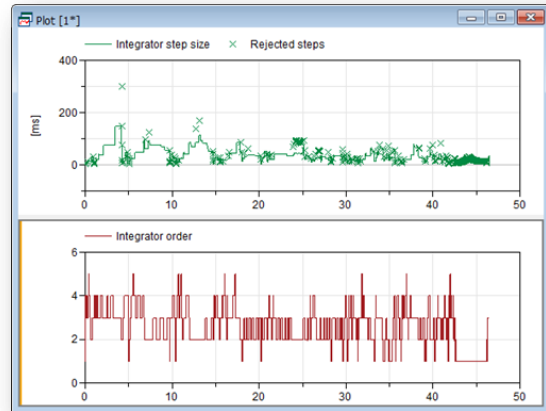
Efficient simulation

- ▶ Sparse solvers
 - ▷ Very efficient simulation of some models, beating the published benchmark by several factors
 - ▷ In some cases RK-solvers are critical for efficient simulation (case #2 in figure)
- ▶ New solvers for embedded code
 - ▷ Deterministic real-time properties for non-linear equation systems



Analyzing numeric integration

- ▶ Easier to understand numeric integrator behavior for difficult models
- ▶ Faster simulation, helps find bugs
- ▶ Analyzing global behavior
 - ▷ Integrator step size
 - ▷ Reject steps (integrator restart)
 - ▷ Integrator order

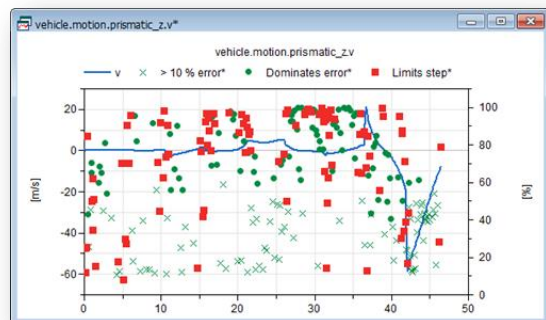


3DS.COM/CATIA © Dassault Systèmes | Confidential Information | 2017-05-31 | ref.: 3DS_Document_2015

5

Analyzing numeric integration

- ▶ Overview of error from all states
 - ▷ Table view of all states
- ▶ Analyze how an individual state affects integrator behavior
 - ▷ Plot variable and points where it affects the numeric integration (relative total error)
 - ▷ Identify hot-spots during simulation period



3DS.COM/CATIA © Dassault Systèmes | Confidential Information | 2017-05-31 | ref.: 3DS_Document_2015

6

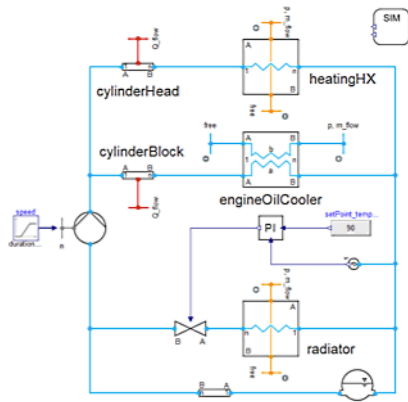
New Modelica libraries

New libraries

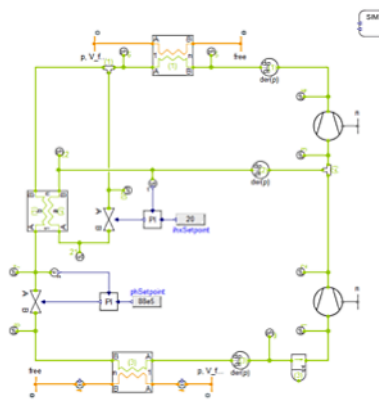
- ▶ **Thermal Systems Library**
 - ▷ Stationary and transient simulation of freely configurable thermodynamic systems
- ▶ **Vehicle Systems Modeling and Analysis (VeSyMA) Library**
 - ▷ Conventional, hybrid, electric and novel vehicles
 - ▷ Predict their performance, fuel economy and energy usage
- ▶ **Vehicle Systems Modeling and Analysis (VeSyMA) – Powertrain Library**
 - ▷ MultiBody mechanics with detailed shaft, bearing and gear mesh models
- ▶ **Vehicle Systems Modeling and Analysis (VeSyMA) – Suspensions Library**
 - ▷ Multi-body suspension, tire and driver models for studying vehicle dynamics

Thermal Systems Library – Applications

Cooling Systems



Transport Refrigeration

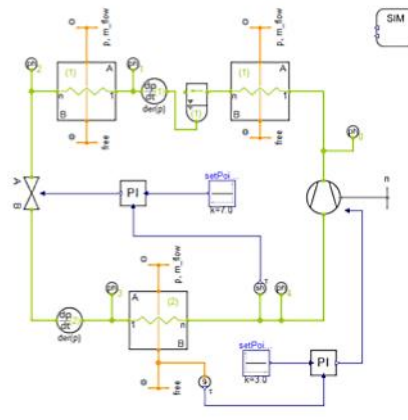


3DS.COMCATIA © Dassault Systemes | Confidential Information | 2017-05-31 | ref.: 3DS_Document_2015

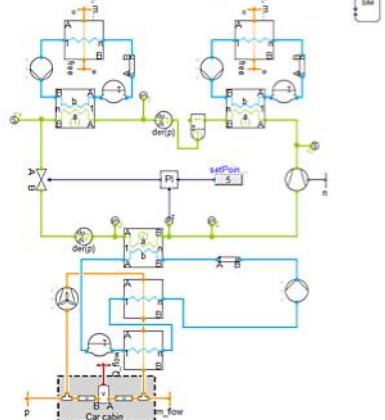


Thermal Systems Library – Applications

R134a AC Cycle



Secondary Loop



3DS.COMCATIA © Dassault Systemes | Confidential Information | 2017-05-31 | ref.: 3DS_Document_2015



VeSyMA – Vehicle System Modeling and Analysis

- ▶ Core library for modelling of conventional, hybrid, electric and novel vehicles
- ▶ Used to predict performance, fuel economy and energy usage
- ▶ Includes experiments for
 - ▷ Straight line acceleration
 - ▷ Drive cycles
 - ▷ Gradeability tests
- ▶ Set of common vehicle templates
 - ▷ But full flexibility to be reconfigured to look at any vehicle architecture idea
- ▶ Replaces Powertrain library in Dymola portfolio

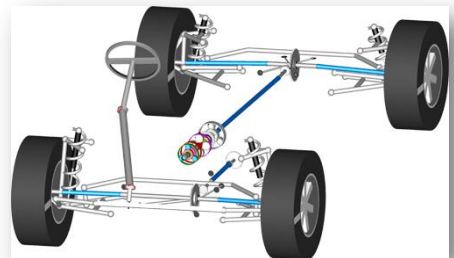
3DS.COM/CATIA © Dassault Systemes | Confidential Information | 2017-05-31 | ref.: 3DS_Document_2015

11



VeSyMA - Powertrain

- ▶ Used for modelling automotive powertrains from concept evaluation to detailed MultiBody models for detailed analysis capturing the full motion of the powertrain
- ▶ Hardware specification – complete torsional characteristic of transmission and driveline
- ▶ Modal analysis of the powertrain for predicting torsional excitation modes i.e. shuffle
- ▶ Shift quality and feel - detailed components for capturing the dynamics of the gear shifting system
- ▶ Fully compatible with the VeSyMA Suspensions library allowing the interaction between the chassis and powertrain to be analyzed



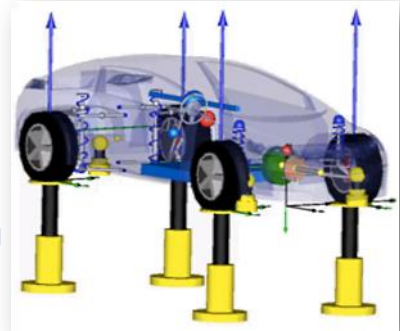
3DS.COM/CATIA © Dassault Systemes | Confidential Information | 2017-05-31 | ref.: 3DS_Document_2015

12



VeSyMA – Suspensions

- ▶ Extends the VeSyMA library for vehicle dynamics applications
- ▶ Comprehensive range of experiments
 - ▷ Rig, static and dynamic tests – from quarter car to full vehicle
 - ▷ Open and closed loop driver models
 - ▷ 3D roads
- ▶ Suspension models for vehicle dynamics analysis of cars
 - ▷ MultiBody suspension models provided include: double wishbone, integral link, multi-link, trailing arm and MacPherson strut
 - ▷ Table based suspension models
 - ▷ Use ideal joints or bushes
- ▶ Designed with real-time simulation in mind
- ▶ Replaces Vehicle Dynamics Library in Dymola portfolio



IF WE  TM