# Symbolic Computation Techniques for Efficient Physical Modeling with MapleSim

Maplesoft is the first North American supplier of technical software to embrace the Modelica standard through their modeling and simulation tool, MapleSim. MapleSim promotes the acausal modeling approach that has been advanced by the Modelica Association for several years, but at its core uses symbolic techniques provided by Maple to generate model equations.

With MapleSim, one creates the system diagram on-screen and the equations of the model are automatically generated. The equations can be viewed and manipulated within the Maple environment where one can take advantage of Maple's numerous standard packages for dynamic system analysis, optimization, or statistics. The Maple programming language can be used to further manipulate and create applications around models.

MapleSim's support for modeling multibody systems provides the user with a choice of coordinate sets, giving one control over the form of the resulting model equations. Models can be conceptualized using the 3-D visualization engine (as the model is constructed), providing greater insight into the topology and dynamic system behaviour.

MapleSim builds on Maple's numeric and symbolic computation to perform simulations of complex models. The equations generated from the model are simplified symbolically and higher index DAEs are reduced using Maple's index reduction algorithms, which also remove redundant equations and flag inconsistencies within the model. The simplified model is numerically simulated, with compilation options for further gain in speed of execution.
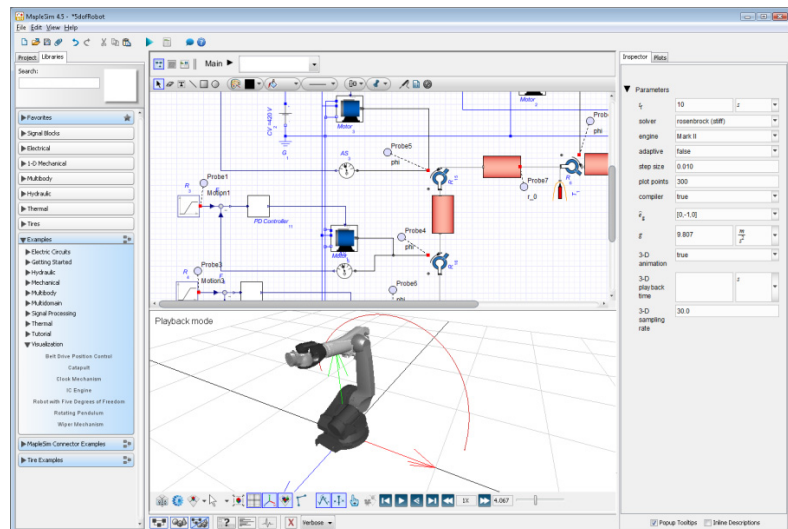
MapleSim has the ability to convert models to C code using Maple's code generation and optimization tools. It also offers a Connectivity Toolbox for export of models into the Simulink® environment.

This presentation will give an introduction to this approach to model formulation, simplification, simulation, and 3-D visualization. It will also outline some of the model documentation capabilities of MapleSim and its easy integration with the Maple engine.

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