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MathModelica - A Full System Simulation Tool

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Abstract

The objective of this paper is to demonstrate the new software MathModelica and also give a brief overview of some industrial and academic pilot projects where it has been used. MathModelica is a modeling, analysis, and simulation environment for engineers at companies which design complex products or systems of physical character. The tool is built to support the iterative design and modeling process of complex systems where analysis, technical computations, partial models, simulations, documentation, and control system design are non-separable issues. Today this process is carried using a broad range of tools. In MathModelica the modeling and simulation capabilities are tightly integrated with an environment for technical computations which supports the engineering design process from initial assumptions and tests to a final complex multi-domain model.

MathModelica is useful in a variety of areas such as the automotive and aircraft industries, robotics, and complex machinery. The tool provides a technology that makes it possible to 'lift' modeling and simulation one or several levels closer to the real product than what is possible with most of today's software tools. Virtual prototyping is a common term for parts of this process but does usually only include the mechanical modeling part of the whole system. Full system simulation is a more accurate description of what MathModelica provides.

The software provides both graphical and textual facilities for designing, programming, documenting, simulating, analyzing, and publishing multi-domain models. Due to its power and ease of use, it permits creation of 'virtual prototypes', computer simulations that behave like a real physical object or system, e.g., an electrical network, a turbo engine, an aircraft, or an industrial robot. The software consists of several modules for different purposes and are used in different phases of the modeling process. The basic modules are the *Model Editor* and *Notebook*s. MathModelica integrates and extends a number of softwares such as the technical computing system *Mathematica* from Wolfram Research, a diagram and visualization tool, and simulation algorithms from Dynasim. This means that the MathModelica environment consists of well developed and reliable software integrated in an environment for technical computations.

Recently, MathCore have started a number of pilot projects for multi-domain modeling and simulation together with a few industrial and academic partners. The paper will also include an overview of one or more of these projects and their results.