

Mathematical Aspects of Object-Oriented Modeling and Simulation

The object-oriented modeling language Modelica (www.modelica.org) provides powerful features that make it possible to build up and simulate very complex even hybrid systems quite easily. But, what happens if a Modelica tool is not capable to compile and/or correctly simulate the system of interest? Reasons can be i.e. modeling errors, wrong parameter values and/or numerical instabilities. Automatic problem detection is usually not possible and only understanding of symbolical and numerical techniques behind the scene can help in resolving this issue. This tutorial provides a basic understanding on the mathematical aspects of object-oriented modeling and simulation. The different phenomena are explained in detail using simple Modelica examples which can be thoroughly analyzed during hand-out exercises. The following relevant topics will be discussed.

Continuous system simulation

- Introductory examples
- Symbolic transformation
- Efficiency issues and nonlinearities
- Higher index problems
- Initialization
- Numerical issues

Mixed system simulation

- Event handling
- State events versus time events
- Symbolic transformation
- Ideal components
- Varying higher index problems
- Efficiency and numerical issues

Biography:

Prof. Dr. Bernhard Bachmann received his Ph.D. in Mathematics from the University of Zürich, Switzerland, in 1994. After working several years in industry, he has been appointed in 1999 Professor of Mathematics at the University of Applied Sciences in Bielefeld, Germany. His research areas are numerical analysis, scientific computation, and object-oriented modeling and simulation. Dr. Bachmann is a member of the Modelica Association and the Open Source Modelica Consortium.

