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Borut Zupančič received Ph.D in 1989 and became full professor at the Faculty of Electrical Engineering, University of Ljubljana in 2000. His major research interests are: multi-domain and object oriented modelling and simulation, continuous and hybrid control systems design, harmonization of thermal and flows in buildings.

He is the author of more than 200 conference papers and 50 papers in scientific journals, co-author of one international book (published by Prentice Hall Inc.) and author or co-author of several books in Slovene language. He was the vice dean at the Faculty of Electrical Engineering University of Ljubljana 1999-2003, currently he is the head of the Laboratory of Modelling, Simulation and Control and the head of the Chair for Control, Systems and Cybernetics at the same faculty. He is the president of the Slovene Society for Modelling and Simulation (1994-2002 and from 2010). He was the president of EUROSIM, the federation of European simulation societies in the period 2004-2007 and the congress chair of the 6th EUROSIM congress 2007 in Ljubljana. From 2010 he is the secretary of EUROSIM.

Realisation preserving modelling in Modelica

Keywords: Realisation-preserving modelling, Object oriented modelling, Acausal modelling, Physical modelling, Multi-domain modelling, Model reduction.

Abstract

Realisation-preserving modelling means in this contest a modelling when a computer aided approach is used with the basic aim to keep the physical structure of a real system or its topology as much as possible in the model. Bond graphs represent a very efficient and traditional approach. However new object-oriented and multi-domain tools based on Modelica language are more appropriate for industrial staff or for the people who do not have a deep insight into modelling and simulation. The important advantages of such tools in comparison with traditional block oriented modelling approaches are described: acausal modelling, object oriented approach, component coupling, hybrid features and symbolic processing. In the paper we also describe several education and industrial application projects in Dymola-Modelica environment and some experiences obtained from these projects but also from more general usage of the Modelica environment through many years.

One of important observations was that some of our models proved to be very complex and difficult to verify and validate. We also experienced numerical difficulties at simulations that were intricate to resolve. So, a conclusion was that our models are too complex and should be simplified. Large models in Modelica are usually hierarchically organised whereby on a higher levels a model is described graphically with schematic diagrams and on lower levels textual description is used, e.g., by stating constitutive equations of the system's components. Therefore we proposed some model reduction solutions for both mentioned approaches.