Modelling and Simulation in Engineering

Special Issue on

System Modeling and Simulating through Equation-Based Models and Acausal Programming

CALL FOR PAPERS

Modeling and simulation (M&S) represents a mainstream technique for designing and studying systems in a variety of industrial and scientific domains. M&S methods, tools, and techniques allow effectively analyzing and evaluating design alternatives by avoiding risks, costs and fails associated with extensive field experimentation; this opportunity becomes even crucial when complete and actual tests are too expensive to be performed in terms of cost, time, and other primary resources. In the M&S arena, there is an increasing interest in the exploitation of equation-based models and acausal programming paradigm due to their flexibility in handling the system complexity. Indeed, an acausal style of programming allows specifying programs in terms of attributes, classes, and their relationships in a declarative manner by following an equation-based style which in turn provides a better (re)use of classes since equations do not specify a data flow direction and thus can represent different behavioral models on the basis of the actual inputs provided during the model execution.

An example of mature acausal modeling language is Modelica whose popularity is constantly increasing as also stated by Modelica-based important European project such as MODRIO, which involves important player of the Modelica Association. However, wider adoption of the acausal programming paradigm requires further investigations on conceptual properties representation, model binding, and automated model composition, tracing, and verification.

In this context, the special issue aims to gather results and progresses in M&S system through equation based models and acausal programming thus contributing to the advancements of the state-of-the-art. In particular, the scope of the special issue is to present research activities that use the acausal programming paradigm to analyze and solve scientific and industrial problems in different domains ranging from aerospace to energy. Specifically, the issue aims at (i) presenting the current SOTA about acausal and equation-based programming along with languages extensions and recent innovations experimented on real case studies; (ii) identifying potential research directions and technologies that will drive innovations in systems engineering domains for improving systems diagnosis, operation, and performance; (iii) showing and sharing, among the communities, ideas and achievements in holistic modelling and simulation as well as providing frameworks and simulation platforms for supporting the implementation of cyber-physical systems.

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