Minisymposium on

Validated Methods: Applications to Modeling, Analysis, and Design of Systems in Medicine and Engineering

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During the last decades, computer assisted modeling and analysis of different industrial processes gained in importance. Computers help to reduce the design and development time for new products and to substitute low cost virtual tests for expensive experiments on real life prototypes. However, the results are often unreliable due to errors that are generated either by the underlying computer arithmetic or by inaccuracy resulting from idealization of the mathematical model of the considered process. In this minisymposium, we focus on validated methods as a means to solve such problems.

A method is called *validated* if it guarantees the correctness of its output. In this context, intervals and Taylor models are widely used approaches to validating results obtained on a computer. For example, the former provides a (multidimensional) box described in terms of floating point arithmetic which is guaranteed to contain the exact result. Besides, these methods are able to allow for uncertainty in parameters, which helps to generate more realistic mathematical models or take into account measurement errors.

The goal of this minisymposium is to make validated methods known to a broader circle of industry representatives. For this purpose, we outline their potential by presenting selected applications in medicine and engineering.

In this minisymposium we will give an overview of modern validated methods and corresponding software libraries. We will focus on applications of these techniques to real life problems. In particular, the following topics will be considered:

– verification of multibody kinematics and dynamics in SmartMOBILE,
– simulation of motion for biomechanical tasks,
– applications of guaranteed computation in robotics,
– validated parameter estimation for the characterization of micro systems,
– analysis of the impact of infections within a population using epidemiological models with uncertainties,
– validated analysis of uncertain models of human blood cell dynamics, and
– design of nonlinear stabilizing control strategies for uncertain bioprocesses.

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