Automation of computational modeling by advanced software tools and techniques

Many advances in the reliability, generality and interdisciplinary nature of new computational methods developed in recent years can be attributed to a holistic approach to computational modeling, in which advanced software tools and techniques are combined with advanced numerical methods. This holistic approach is playing a central role in a process that ultimately leads to a complete automation of computational modeling. The automated generation of computational models has been explored by researchers from the fields of mathematics, computer science and computational mechanics, resulting in a variety of approaches (e.g. object-oriented, domain specific languages and hybrid symbolic-numeric methods) and available software tools (e.g. symbolic and algebraic systems, automatic differentiation tools, problem solving environments and numerical libraries). Automation can address all steps of a finite element solution procedure from the strong form of a boundary-value problem to the visualisation of results, or it can be applied only to the automation of selected steps in a whole procedure.

This symposium will address the broad area of advanced software technologies for scientific computing, including:

- the use of symbolic and automatic differentiation tools in the development or derivation of computational models;

- domain specific languages for numerical analysis;

- automated tools for advanced architectures; and

- software tools and methods for parallelization and coupling.