14th World Congress on Computational Mechanics (WCCM XIV)
8th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS 2020)
July 19–24, 2019, Paris, France

# EFFICIENT SIMULATION AND OPTIMISATION OF TIME-DEPENDENT FLUID AND HEAT TRANSFER SYSTEMS (TRACK NUMBER 600)

**JOE ALEXANDERSEN[*], FRED VAN KEULEN[†] AND PHILIPP BIRKEN[⋆]**

[*] Technical University of Denmark, Nils Koppels Allé 404, DK-2800 Kgs. Lyngby, Denmark
joealex@mek.dtu.dk

[†] Delft University of Technology, Mekelweg 2, 2628 CD DELFT, The Netherlands
A.vanKeulen@tudelft.nl

[⋆] Lund University, Box 117, 221 00 LUND, Sweden
philipp.birken@math.lu.se

**Key words:** time-dependent, heat transfer, fluid flow, optimization, adjoint sensitivities

## ABSTRACT

The proposed minisymposium (MS) will showcase the current state-of-the-art within efficient simulation and optimisation methods for time-dependent heat transfer and fluid-based systems, such as electronics cooling, thermal energy storage, microfluidic devices, precision tools, fluidic actuators, etc.

Simulation-based optimisation is a computationally heavy task due to the iterative nature of the optimisation process involving hundreds, if not thousands, of simulations. The higher the model complexity (non-linearities, time-dependency, etc.), the higher the cost. Most often the simulations used to evaluate performance (the forward problem) and the design sensitivities/gradients (the adjoint/backward problem) are the computational bottleneck. Thus, highly efficient simulation methods are needed in order to treat transient problems in a manageable time frame. For adjoint sensitivity analysis, a further problem is handling the massive amounts of data generated, since the full forward time history is needed during the backward solve. This requires either significant data storage or costly recomputations.

The MS invites contributions within both heat transfer and fluid-based problems, as long as the treated problem is time-dependent. Special focus will be on shape and topology optimisation, but papers applying other optimisation methods are also welcome. Furthermore, the MS also invites papers treating time-dependent simulations of heat transfer and fluid problems as long as focus is on making these techniques more efficient, because this can help the optimisation community to accelerate progress. Examples could be using advanced discretisation schemes and numerical methods such as (but not limited to): discontinuous Galerkin, multigrid (in time and space), parallel-in-time, multirate integration, reduced basis approaches, etc.

Submissions to the MS are expected to push the horizon of this developing research field. Submissions may treat anything from simple two-dimensional investigations to realistic three-dimensional problems, as long as a practical problem is kept in mind.