11th. World Congress on Computational Mechanics (WCCM2014)
5th. European Conference on Computational Mechanics (ECCM V)
6th. European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

THERMOMECHANICAL COUPLING IN FLUIDS, STRUCTURES AND FLUID-STRUCTURE-INTERACTION

PHILIPP BIRKEN[*], WAGNER C. FLEMING PETRI[†], DETLEF KUHL[†] AND ANDREAS MEISTER[*]

[*] Institute of Mathematics, University of Kassel
Heinrich-Plett-Str. 40, 34132 Kassel, Germany
fbirken,meisterg@mathematik.uni-kassel.de, http://www.mathematik.uni-kassel.de

[†] Institute of Mechanics and Dynamics, University of Kassel
34109 Kassel, Germany
wfp001@alumnus.ucn.cl, kuhl@uni-kassel.de, http://www.uni-kassel.de/fb14bau

Key words: Fluid-Structure-Interaction, thermomechanical coupling.

ABSTRACT

The mechanical and thermal interactions between fluids and structures play a significant role in many manufacturing and technical processes. Rocket, car and airplane engines, wind and gas turbines, rolling and metal forming and the reentry of spacecrafts into the atmosphere are only some selected examples of the broad range of multifield phenomena. As a consequence, computational methods for the prognosis of respected system behaviors under thermal and mechanical actions on the liquid and solid parts are unavoidable for future technical developments. In particular, computing the transfer of momentum and energy between the fluid and the structure is the foundation of realistic simulations for the huge amount of fluid-structure systems mentioned above.

The proposed mini symposium is concerned with mathematical, mechanical and algorithmic aspects of thermomechanical processes in fluids, structures and fluid-structure interactions. Hereby, both monolithic and partitioned solution techniques are considered. Special emphasis is given to structural models that consider structural deformation and heat conduction with thermoelastic, thermoplastic or thermo-viscoplastic material behavior. Other main aspects of the investigations are numerical effort, stability and accuracy, time integration, nonmatching grids at interfaces, solution procedures, added mass effect, energy conservation and moving grids. Practical applications, as e.g. the simulation of process-integrated manufacturing of functionally graded structures, cooling of rocket combustion chambers and energy transfer in gas turbines, complete the proposed mini symposium.