

## INVERSE HEAT TRANSFER PROBLEMS: METHOD AND APPLICATIONS

Yi Heng<sup>1</sup>, Ali Abbas Nejad<sup>2</sup>, Shuai Lu<sup>3</sup>

1. AVT-Process Systems Engineering, RWTH Aachen University, D-52064 Aachen, Germany, yi.heng@avt.rwth-aachen.de
2. Mechanical Engineering Department, Shahrood University of Technology, 3619995161, Shahrood, Iran, abbasnejad@shahroodut.ac.ir
3. School of Mathematical Science, Fudan University, No.220 Road Handan, 200433, Shanghai, China, slu@fudan.edu.cn

**Key Words:** *Inverse Heat Transfer, Regularization, Pool boiling, Alloy solidification, Stefan-Boltzmann radiation boundary condition.*

### PROPOSAL

**Scope of the minisymposium.** Common heat transfer problems are associated with a physical cause-effect behaviour which can be described by mathematical models constituting of differential equations. During the past decades, the theory and application of so-called inverse heat transfer problems (IHTP), which rely on measurements for the estimation of unknown thermal quantities, have attained enormous research interest because of their practical significance as well as the mathematical difficulties and the bottleneck of available computational techniques. In contrast to common heat transfer problems, IHTP are set up to find out effect-cause relations in thermal processes and are often ill-posed. The use of IHTP solution techniques to estimate the unknowns from the indirect observations is more efficient and economical when the direct measurement is not practical due to environmental obstacles or high experimental cost.

**Importance and applications.** IHTP solution techniques become more and more important in almost every branch of scientific and engineering areas. In this minisymposium a few interesting applications will be introduced to emphasize the necessity of IHTP solution techniques. The first example is the efficient reconstruction of unmeasurable local boiling heat flux in pool boiling experiments from high-resolution or point-wise temperature observations. The second example is the reconstruction of time and spatial dependent boundary heat flux in 2D alloy solidification problems using measured temperatures inside the domain. The third example investigates an inverse problem on the determination of boundary coefficients within the framework of Stefan-Boltzmann radiation conditions for the heat transfer process.

### REFERENCES

- [1] Y. Heng, A. Mhamdi, W. Marquardt, Efficient reconstruction of local heat fluxes in pool boiling experiments by goal-oriented adaptive mesh refinement, *Heat and Mass Transfer*, 46, 1121–1135, 2010.
- [2] A. Abbas Nejad, M.J. Maghrebi, H. Basirat Tabrizi, Y. Heng, A. Mhamdi, W. Marquardt, Optimal Operation of Alloy Material in Solidification Processes with Inverse Heat Transfer, *International Communications in Heat and Mass Transfer*, 37, 2010, 711-716.
- [3] J. Cheng, S. Lu, M. Yamamoto, Reconstruction of the Stefan-Boltzmann coefficients in the heat transfer process, Submitted, 2011.