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TWENTY YEARS OF THE CAMES

# Preface

This special issue of the *Computer Assisted Methods in Engineering and Science* comprises selected papers presented during the **Numerical Heat Transfer 2012 International Conference** (**NHT2012**). The conference was organised as a **Special Interest Conference** of the **European Community on Computational Methods in Applied Sciences** (**ECCOMAS**) grouping European associations with interests in the development and applications of computational methods in science and technology. The NHT2012 Conference was held on September 4–6, 2012 in Wrocław, Poland.

Papers published in this special issue (and the papers realised in one of the nearest accompanying special issue CAMES) have been selected to demonstrate an overview of the conference topics as well as, to document the significant advances in numerical heat transfer. This special issue opens with a contribution from Y. Asakuma and T. Yamamoto entitled "Effective thermal conductivity of porous materials and composites as a function of fundamental structural parameters". The authors discuss in their paper the method of calculation of the effective thermal conductivity, allowing one to study the mechanism of heat transfer by three-dimensional finite element method. Particularly, the effects of the change of the composite structure porosity, the particle ratio and the Biot number are investigated.

The next paper in this issue focuses on robust and simple optimization of functionally gradient materials. Namely, G. Maciejewski and Z. Mróz consider effects of combined cyclic thermal and mechanical loadings being applied to valve design. The example included illustrates the optimal density distribution of ceramic phase of $Al_2O_3$ within NiAl matrix. It is important to note that the proposed method shares merits of standard optimization and topology optimization, allowing creating one phase of material inside the other.

The third contribution comes from Majchrzak *et al.* who present the explicit scheme of the finite difference method to analyse the heat conduction caused by the ultra-short laser pulse within thin metal film. The considered thermal problem is described by two-temperature model consisting of the system of two coupled parabolic equations determining the electron and lattice temperatures. Finally, the sensitivity analysis of electron and lattice temperatures with respect to the changes of coupling factor and the film thickness has been determined. The authors conclude that the sensitivity analysis methods presented in this article may be also used to estimate changes in temperature caused by modifications of other parameters, for example, thermal conductivity or volumetric specific heat of lattice.

The next paper by E. Majchrzak and L. Turchan discusses the modelling of heat transfer processes associated with hyperthermia therapy, frequently encountered during various cancer treatment modalities. The tissue is treated as a porous medium, with porosity being the ratio of blood volume to the total volume of the tissue. Such a formulated heat transfer governing equation is then coupled with the differential equations for the blood vessels. Obtained results of calculations are compared to results produced by the classical Pennes bioheat equation.

L. Słupik, J. Smołka and L.C. Wrobel concentrate, in their paper, on the numerical modelling of coupled flow, thermal and electromagnetic problem occurring in a small power electric motor. The developed computer model, built using commercial package ANSYS, was also validated experimentally. Recorded temperatures (using thermocouples and IR camera) confirm consistency and good accuracy of the model, which was finally used to design cooling system of the motor.

The last paper in this issue comes from I. Szczygieł *et al.* and presents computational aspects of the modelling of a single-phase flow occurring within a flotation machine. The authors analyse efficiency of the flotation process strongly dependent on the fluid flow field, structure of air bubbles and the level of fractions mixing. The computer model of the processes is built using the commercial package ANSYS Fluent. The obtained numerical results were compared with the measurements performed on the small scale model of the flotation machine.

I am indebted to all authors for their contributions to this special issue, for their cooperation and support. I do hope that this issue, together with the accompanying CAMES 4/2013, provides a window into the current interests in numerical heat transfer, documenting at the same time recent advances in this fascinating research area.

**Andrzej J. Nowak**
*Chairman of NHT 2012*
*Institute of Thermal Technology*
*Silesian University of Technology, Gliwice, Poland*