Preface

This special issue of the *International Journal of Numerical Methods for Heat and Fluid Flow* (*IJMHFF*) comprises selected papers presented during the *Eurotherm Seminar No. 109 – Numerical Heat Transfer 2015*. The Conference was held on 27-30 September, 2015, in Warsaw, Poland, and it was the 3rd conference in the series, following the previous meetings in Cracow (2005) and in Wrocław (2012). Both the Scientific Committee Members and the Participants came from 17 countries all over the world.

The conference was organised under the auspices of the *EUROTHERM Committee*. The aim of the EUROTHERM Committee is to promote and foster European cooperation in thermal sciences and heat transfer by gathering together scientists, graduate students and engineers working in specialised areas of heat transfer.

The special issue consists of 12 papers which have been selected to demonstrate, on the one hand, an overview of the conference topics and, on the other hand, to present few hot and important topics in numerical heat transfer. The issue starts with the paper by A.J. Kassab *et al.* entitled *Multi-Scale Pulsatile CFD Modeling of Thrombus Transport in a Patient-Specific LVAD Implantation*. Authors refer to cardiovascular problem and present a pulsatile model of the ventricular assist device (VAD) circulation amenable to further studies of thrombus transport aimed at optimizing outflow graft (VAD-OG) implantation. Pulsatile haemodynamics are resolved in a multi-scale scheme by coupling 3D time-accurate CFD computations of the anatomical region of interest with a zero-dimension-lumped parameter electric circuit model of the unresolved peripheral vasculature that provides the driving time-dependent flow and pressure waveforms' boundary conditions. The authors discuss also three sources of potential thrombus entering the aortic VAD and emanating from the inlet of the VAD outflow graft, aortic root and ventricle itself.

Second paper entitled *Optimal Design of Multi-Layer Thermal Protection of Variable Thickness* is prepared by A. Nenarokomov *et al.* The paper presents an algorithm which is based on a sequential quadratic programming (SQP) method and allows for optimal design of multilayer thermal insulation of variable thickness. The desired vector of parameters is defined as the solution of the linearly constrained sub-problem with an objective function (based on the Lagrangian function) with linear constraints chosen in such a way that the space of minimization would be restricted to the subspace of vectors orthogonal to the active constraints' gradients. The obtained results illustrate how the proposed algorithm can be applied for solving a practical problem of thickness sampling for a thermal protection system of an advanced solar probe.

Next paper by K. Wawrzak *et al.* is entitled *Numerical Simulation of Free Jets*. The paper summarizes recent achievements and suggests further research directions in numerical studies (LES and DNS) of round free jets with particular attention on the influence of the inlet parameters (mean velocity, turbulence intensity, length and time scales) on the jet dynamics. The paper also shows complexity of seemingly simple jet-type flow and proves that despite a huge interest in these flows and relatively in-depth knowledge on the jet dynamics, there remain some open issues requiring further studies.

B. Mavrič and B. Šarler in the paper *Application of the RBF Collocation Method to Transient Coupled Thermoelasticity* present solution of the thermoelastic benchmark by considering a linear thermoelastic plate under thermal and pressure shock and by applying

International Journal of Numerical Methods for Heat & Fluid Flow
Vol. 27 No. 5, 2017
pp. 1019-1021

0961-5539
DOI 10.1108/HFF-03-2017-0127

the local radial basis function collocation method (LRBFCM). This LRBFCM solution is compared with the reference FEM solution, and it is found that both solutions are generally very similar with some differences near the tip of the shock front. The LRBFCM appears to converge to the mesh-converged solution more smoothly than the FEM. In this sense, the LRBFCM also performs better than the meshless local Petrov-Galerkin method in all cases studied by authors.

The fifth work from P. Łapka *et al.* is entitled *Assessment of thermal performance of protective garments. The advanced numerical model*. In this paper, the authors present the advanced mathematical and numerical models of conjugated heat and mass transfer in a multilayer protective clothing, human skin and muscle subjected to incident external radiative heat flux. The mathematical model also accounts for associated phase transition of the bound water in the fabric fibres and diffusion of the water vapour in the clothing layers and air gaps. The heat transfer in the skin and muscle is modelled using two equation models coupled with an arterial blood flow model. The results of the numerical simulation are used to estimate the risk of the first-, second- and third-degree burns.

Next paper entitled *Progress in Thermal Transport Modeling of Carbonate-based Reacting Systems* was prepared by W. Lipinski *et al.* This work reviews recent progress in numerical modelling of thermal transport phenomena in carbonate-based heterogeneous reacting systems with applications to thermochemical carbon dioxide capture and energy storage. Analysing the developed model and the obtained results, the authors conclude that cycle times affect the maximum sorbent utilization and solar-to-chemical energy efficiency. They also underline that effective solar thermochemical reactor designs should maximize solar-to-chemical energy conversion by rational coupling of chemical kinetics with reactor heat and mass transfer processes.

Seventh paper by L. Dombrovsky and W. Lipinski is entitled *Simple methods for identification of radiative properties of highly-porous ceria ceramics in the range of semi-transparency*. The authors, assuming that the scattering properties of ceramics are temperature-independent, present advancements in the experimental–numerical methodology for determining of spectral radiative properties (i.e. the absorption coefficient) of highly porous ceria ceramics at room and elevated temperatures. Additional measurements of the normal emittance of the same sample heated uniformly from both sides by external radiation are proposed to identify temperature dependence of the absorption coefficient. The authors also present the relationship (in an analytical form) between the normal emittance and absorption coefficient. Besides, they underline that satisfactory estimates can be obtained even for very low values of the absorption coefficient in the near-infrared range.

The main goal of the contribution by L. Mazzei *et al.*, entitled *Assessment of modelling strategies for film cooling*, is the validation of two computational approaches applicable to modelling of the film cooling of aero-engine combustors liners. These two approaches differ mainly with the way a coolant is injected (i.e. either through point source or distributed mass sources) and have been compared focusing on the prediction of both adiabatic effectiveness and heat transfer coefficients. The test cases are represented by effusion-cooled flat plates investigated experimentally in the context of EU projects KIAI and NEWAC. The authors clearly demonstrate the feasibility of obtaining a sufficiently accurate reproduction of coolant protection in conjunction with significant saving in terms of computational cost.

The next contribution by R. Yadav *et al.* is entitled *Implementation of SLW model in the radiative heat transfer problems with particles and high temperature*. In this paper, implementation of spectral line-based weighted sum of grey gases (SLW) model in an axisymmetric cylindrical geometry with high temperature gradients is discussed. This type of problem can occur in many practical situations, and just as examples, the authors point out industrial furnaces and rocket exhausts. The radiative transfer equation is solved by modified discrete ordinates method. Behaviour of three non-grey gases – H_2O, CO_2 and CO – has been described using hyperbolic tangent correlation for the absorption line blackbody distribution function. The non-grey behaviour of the particles is converted to grey behaviour at the mean wavelength and temperature.

Tenth paper entitled *Code-to-code verification of an axisymmetric model of the Bridgman solidification process for alloys* is submitted by M. Seredynski *et al.* In this paper, the computational modelling of the Bridgman solidification process of alloys is discussed. Authors particularly investigate a two-dimensional axisymmetric transient solidification considering two possible scenarios, i.e. pulling rate step change and ramp input. Then the authors compare (the code-to-code verification) solutions obtained by in-house code and by well-established commercial code (ANSYS Fluent). Good conformity of results is demonstrated together with the ability of the in-house code with radial heat transfer.

Next contribution by Y. Girodhar and G. Dutta is entitled *Nuclear Coupled Thermal Hydraulic Analysis of Fast Transient Depressurization in Supercritical Channels*. The main purpose of this paper is to simulate the fast depressurization process caused by loss of coolant accident (LOCA) in a nuclear reactor. The emphasis in these simulations is on analysing the phenomenon of the deterioration in heat transfer (DHT) inside the channel subjected to sharp pressure variations. The authors underline good agreement in the predicted behaviour of the supercritical water pressure system with that of the available experimental data for the steady-state case.

The last contribution by R. Straka and T. Telejko is entitled *Numerical model of a shaft furnace operation*. This paper discusses operation and relevant computational model of the rock melting cupola used in mineral wool production. The model combines basic balance equations with chemical reactions and heat and mass transfer correlations. Comparison of obtained numerical results with measurements allowed the authors to validate their model.

I am indebted to all authors for their contributions to this special issue, and for their cooperation and support. I do hope that this issue provides a window to the current interests in numerical heat transfer which is a fascinating research area. I would also like to thank Professor R.W. Lewis, Editor-in-Chief for giving me the opportunity to edit this special issue. I am also very grateful to the editorial staff of the *IJMHFF* for the highly professional handling of this special issue.

Andrzej J. Nowak
Institute of Thermal Technology, Silesian University of Technology, Gliwice, Poland