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Preface

This special issue of the *Computer Assisted Methods in Engineering and Science* (and the papers in the accompanying special issue CAMES 4/2015) comprises selected papers presented during the **Eurotherm Seminar No 109 – Numerical Heat Transfer 2015**. This conference was organised under the auspices of the **EUROTHERM Committee** on 27–30 September, 2015 in Warsaw, Poland. The aim of the EUROTHERM Committee is to promote and foster European cooperation in thermal sciences and heat transfer by gathering together scientists and engineers working in specialised areas.

This issue starts with a contribution by A. Bulińska and Z. Buliński entitled "A CFD analysis of different human breathing models and its influence on spatial distribution of indoor air parameters". The paper focuses on the analysis of three breathing models for application in the CFD modelling. The first model is restricted to constant exhalation. The second one (known as full breathing) consists of constant rate inhalation, constant rate exhalation and pause period. In the third model, temporal variation of flow rate was represented by sinusoidal function. The authors showed that all these three models lead to only small differences in spatial distribution of CO_2 concentration and velocity in the vicinity of the mouth and above the person. They also demonstrated that simplified constant exhalation model can be effectively used for the CFD analysis of the indoor air quality. The main findings from this work show that all three models compared with experimental data gave reliable results. However, detailed simulation of micro-environment in the room and contaminants transport should include complete breathing.

The next paper in this issue (M. Harris, A. Kassab, E. Divo) focuses on the use of the radial basis functions (RBF) which have an impressive capability in interpolating scattered data, even for data with discontinuities. To obtain accurate approximations required when solving partial differential equations, the shape parameter must be chosen properly while avoiding ill-conditioning of the interpolating matrices. The authors discuss the use of RBF interpolation in the approximation of sharp gradients or shocks by the use of an RBF blending interpolation approach which maintains the optimum shape parameter depending on the field. They also demonstrate how to adjust the shape parameter accordingly to keep excellent accuracy. As an example of proposed methodology and as a test of the accuracy of the RBF blending interpolation approach, the Burger's equation is solved using the virtual finite difference method.

M. Jaszczur, I. Polepszyc, M. Dudek in their work entitled "An analysis of the boundary conditions model influence on the ground temperature profile determination" present a numerical model of transport phenomena in the domain above the top surface of the ground surface as well as in the ground below the heat pump installation. Five different models with different boundary conditions have been implemented and obtained results were presented and compared. Additionally, the authors determined the coefficient of performance of the heat pump installation.

The fourth contribution comes from I. Nowak and G. Nowak who present the application of the real ant colony optimization as a tool for multi-criteria optimization problems. All necessary modifications making possible to use this method to simultaneously search of many Pareto-optimal solutions are discussed. The method was numerically tested on benchmark-type problems and used for solving two different engineering problems.

In the next paper entitled "Numerical simulations of a conceptual blade cooling with a working medium", K. Rogoziński and G. Nowak discuss a concept of using working steam as the cooling medium after it is expanded in a convergent-divergent nozzle. In this approach, the cooling system is fairly simple and the computer simulations that the authors have carried out indicate that the turbine blades may be effectively cooled in this way.

W. Strycznewicz and A.J. Panas in they work entitled "Numerical data processing from a laser flash experiment on thin graphite layer" propose the methodology for determination of the out-of-plane thermal diffusivity of a thin graphite layer deposited onto a substrate of known properties. The developed methodology is based on combined (experimental-numerical) procedure which requires formulation and numerical solution of a certain inverse heat conduction problem for a three-layer specimen. The procedure has been successfully tested while processing the real experimental data from investigation of flake graphite layers.

The last paper in this issue is co-authored by S. Wen, K. Wang, R. Zahoor, M. Li and B. Šarler and presents the solution of Stokes flow problems by a non-singular method of fundamental solutions which does not require artificial boundary. In this work, the fundamental solution is obtained from a non-singular function called blob, having a free parameter epsilon. The analytical expressions for related Stokes flow pressure and velocity around such regularized sources have been derived for rational and exponential blobs in an ordered way. The authors showed that exponential blobs give slightly better results than the rational blobs, they require, however, slightly more computing time. A robust and efficient strategy to find the optimal value of epsilon is needed in the perspective.

I am indebted to all the authors for their contributions to this special issue, and for their cooperation and support. I would also like to express my appreciation to Mr. B. Lempkowski, CAMES Editorial Coordinator and his co-workers for their highly professional help. I do hope that this issue, together with the accompanying issue of CAMES 4/2015, provides a window on the current interests in numerical heat transfer, documenting at the same time recent advances in this fascinating research area.

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