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Editorial

Advanced Techniques in Computational Mechanics

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Computational mechanics has suffered significant developments in the last decades. Novel numerical models have been proposed to model solid and fluid problems, as well as to deal with solid-fluid interaction. Many of these methods are based in a spatial description of the model by points (such as in Meshless methods) or in enrichment strategies of the classic finite element method (such as in the GFEM, XFEM, or EFEM). In many cases, these methods became more efficient and accurate than classical formulations and are very competitive in applied mechanics. All contributions included in this special issue address this challenging and broad topic that we, as editors, have the pleasure to share with the readers. We would like to thank all the authors for their commitment in this issue, as well as the reviewers for their critical and detailed assessment.

This special issue is composed of eight research papers and one review paper. The covered subjects are very broad, including topics such as fluid mechanics, solid mechanics, and optimization problems. Below, a very brief overview of the featured works is given.

The "*Numerical study on the charge transport in a space between concentric circular cylinders*," by Y. K. Suh and K. H. Baek, addresses what the authors call essential elements of numerical solution methods for the charge transport equations. The authors argue on the uttermost importance of maintaining the conservation property in convective terms because of the numerical accuracy, in particular at low reaction rates.

In the work entitled "*A numerical scheme based on an immersed boundary method for compressible turbulent flows with shocks: application to two-dimensional flows around cylinders,*" S. Takahashi et al. develop a computational code adopting immersed boundary methods for compressible gas-particle multiphase turbulent flows. A second-order pseudo skew-symmetric form with minimum dissipation models the turbulent flow region, while the monotone upstream-centred scheme for conservation laws scheme is employed in the shock region.

The paper by N. Pochai, entitled "*Numerical treatment of a modified MacCormack scheme in a nondimensional form of the water quality models in a nonuniform flow stream,*" makes use of two mathematical models to simulate water quality in a nonuniform flow stream. The author proposes an alteration to the MacCormack method that is more accurate than the classic method, without a significant loss of computational efficiency.

The work by J. Elíasson, entitled "*Eddy heat conduction and nonlinear stability of a Darcy Lapwood system analysed by the finite spectral method*," proposes a finite Fourier transform to perform linear and nonlinear stability analyses of a Darcy-Lapwood system of convective rolls. The author shows how many modes are unstable, the wave number instability band within each mode, the maximum growth rate (most critical) wave numbers on each mode, and the nonlinear growth rates for each amplitude as a function of the porous Rayleigh number.

In the paper "*Experiment and application of market-based control for engineering structures,*" by G. Li et al., an experimental study on the vibration control of a single-degree-of-freedom model is carried out to verify market-based control (MBC) strategy effect. The authors' results reveal that the MBC strategy can reduce both displacement and acceleration responses. Additionally, the authors apply the MBC strategy to a long-span bridge considering the travelling wave effect.

M. Li et al. propose a quartic B-spline method for solving linear sixth order boundary value problems in the paper entitled "*The numerical solution of linear sixth order boundary value Problems with quartic B-splines.*" Their method converts the boundary problem to solve a system of linear equations and obtains coefficients of the corresponding B-spline functions. Two numerical examples are used to verify the theoretical framework and validate the method.

The paper "*A conjugate gradient method with global convergence for large-scale unconstrained optimization problems,*" by S. Yao et al, proposes a conjugate gradient method that is similar to Dai-Liao conjugate gradient method, but with better convergence properties. This is shown using different test problems.

B. Zhi and Z. Ma, in the paper "*Path transmissibility analysis considering two types of correlations in hydropower stations,*" present their research on disturbance- and parameter-related transfer paths in a practical situation related to hydropower station units and powerhouses. The authors state that their results indicate that the proposed methods can efficiently reduce the disturbance range and accurately analyse the transfer paths of hydraulic-source vertical vibration in hydropower stations.

Finally, a review paper by D. Soares Jr. and L. Godinho, entitled "*An overview of recent advances in the iterative analysis of coupled models for wave propagation,*" presents an overview of the application of iterative procedures for coupling between different methods in wave propagation analysis. Both frequency- and time-domain analyses are addressed in acoustic, mechanical, and electromagnetic wave propagation problems.

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