



Foreword to the Special Focus on Advances in Symbolic and Numeric Computation IV

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Published online: 16 May 2022

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The present Special Focus of *Mathematics in Computer Science* is connected to SYMCOMP2021, the 5th International Conference on Numerical and Symbolic Computation: Developments and Applications. Due to the Covid-19 pandemic, this conference ran in an online format, during March 25–26, 2021, being the virtual host, the University of Évora in Portugal. This ECCOMAS Thematic Conference was a joint organization of IDMEC (Mechanical Engineering Institute) and UÉvora (University of Évora), under the auspice of APMTAC (Portuguese Society of Theoretical, Applied, and Computational Mechanics).

The conference counted with the sponsorship of Wolfram Research which distinguished two Young Researchers for their relevant works, as in previous editions of this event.

The conference proceedings book (ISBN-978-989-99410-6-9) is published online on the ECCOMAS website.

Most of the papers in this special focus are extended or new versions of communications presented at the 5th International Conference on Numerical and Symbolic Computation, being their topics example of the multidisciplinary character of this event.

Numerical and symbolic computation methods and techniques are undoubtedly fundamental tools in a wide range of science and technology fields, as illustrated by the following six papers selected for this Special Focus.

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Symbolic approach to 2-orthogonal polynomial solutions of a third order differential equation***Teresa Augusta Mesquita***

The symbolic approach presented in this work intends to find 2-orthogonal eigenfunctions of a third-order differential operator of the form $p_3(x)D^3 + p_2(x)D^2 + p_1(x)D + p_0(x)I$, $\deg(p_i(x)) \leq i$. The implementation here proposed is a crucial instrument for finding complete descriptions of such 2-orthogonal sequences or establishing the non-existence of solutions; it may also be a highly relevant tool to search this type of polynomial' sequences characterized as eigenfunctions of given differential operators.

Dealing with the resolubility of evolution algebras***D. Fernández-Ternero, V. M. Gómez-Sousa and J. Núñez-Valdés***

This paper deals with the concepts of solvability and nilpotency of evolution algebras, namely, Lie algebras or Leibniz and Malcev algebras. Novel results arising from this work are presented, as well as some examples that illustrate them. The main result achieved states that an evolution algebra is solvable if and only if its structure matrix is nilpotent, implying in turn that the solvability and the nilpotency indices of that algebra coincide, provided the corresponding evolution operator is an endomorphism of the algebra.

A time-splitting Tau method for PDE's: a contribution for the spectral Tau Toolbox library***J. A. O. Matos, J. M. A. Matos, N. Lima and P. B. Vasconcelos***

This work proposes an implementation approach for solving time-dependent partial differential problems using the spectral Tau method, deployed in the Tau Toolbox software library (a numerical library to solve integro-differential type problems). This extension implementation highlights the orthogonal basis choice, the construction of the problem's algebraic representation, and the mechanisms for dealing with certain partial differential problems. This paper is a first effort towards the creation of generic solvers for tackling the type of partial differential problems there described.

Non-homogeneous chain of harmonic oscillators***Luís Bandeira and Carlos Correia Ramos***

In this paper, different models to study the vibrational properties of non-homogeneous materials are considered and compared. The idealized materials are composed of one-dimensional chains of harmonic oscillators represented by an alternating sequence of particles and springs. The homogeneous chains are used as basic building blocks for characterizing the global dynamics of the system. The authors determine the solutions for a system composed of two distinct homogeneous chains based on the solutions for the uncoupled homogeneous chains. Different kinds of couplings with different physical meanings are considered.

Load bearing capacity of light timber frame walls under fire***Paulo A. G. Piloto and Elza M. M. Fonseca***

This research is focused on the load-bearing capacity of light timber frame walls, protected with one and two layers of gypsum at room temperature and after different fire rating periods. The computational model includes the thermal analysis under standard fire, including all types of materials, and a sequential mechanical analysis with incremental load applied for each fire rating period applied just for the load-bearing material. Nonlinear solution methods are used with small tolerance values for solution convergence to determine the correct temperature and displacement fields. The thermal and mechanical properties are considered temperature-dependent. The mechanical analysis considers large-displacements' behaviour, and the charring effect of wood is included via the reduction of the stiffness and strength of the timber. The numerical results are closer to the method presented in the future version of Eurocode 5, part 1.2.

Play-hysteresis in the joint dynamics of employment and investment***P. R. Mota and P. B. Vasconcelos***

This work analyses hysteresis effects in the joint dynamics of employment and investment using the linear play hysteresis model in a simultaneous equation framework. The empirical application based on quarterly data for Portugal reveals significant hysteresis effects on both employment and investment. However, the estimated band of inaction used as a proxy of the magnitude of hysteresis is larger for aggregate employment. These results have significant consequences for macroeconomic policy. As the effects of severe negative economic shocks (even if temporary) may not be easily reversed, fiscal and monetary policy should be conducted in a more preventive way and respond in a timely, massive, and sustained manner.

As Guest Editors, we are very pleased to make this Special Focus available to the scientific community. Particularly after a whole process, ranging from the conference' organization to the submissions' revision process, that ran in the context of a worldwide very complex situation related to the Covid-19 pandemic.

We sincerely thank the authors of these contributions and the anonymous referees who kindly volunteered their time to review these papers.

We are also grateful for all the collaboration provided by the editorial staff of *Mathematics in Computer Science*.

Finally, we wish to express our special thanks to the Editor-in-Chief, Professor Dongming Wang, and to the Managing Editor, Professor Ilias Kotsireas, for the support and for the opportunity to publish in *Mathematics in Computer Science*.

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