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Special Issue on computational methods in engineering (CILAMCE 2018 – Paris/Compiegne)

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Abstract. This special issue contains selected papers first presented in a short format at the Congress CILAMCE 2018 (39th Ibero-Latin American Congress on Computational Methods in Engineering) held in Paris and in Compiègne, France, from 11 to 14 November 2018.

Keywords: multiscale computations; solid mechanics; fluid mechanics

1. Introduction

CILAMCE 2018 was the thirty-ninth in the series of International Congresses focusing upon Computational Methods in Engineering, held each year in Brazil. Previous meeting have all been organized under umbrella of Brazilian association **abmec**, 'Associação Brasileira de Métodos Computacionais em Engenharia', as the sponsor of CILAMCE Congress series. For this particular Congress, we had additional two sponsors from France: CSMA, Association of Computational Mechanics, and SMAI, Association of Applied and Industrial Mathematics. The institutions organizing CILAMCE 2018 were University of Technology Compiegne, a member of Sorbonne University Alliance, and Escola Politecnica of University of Sao Paulo. The CILAMCE 2018 was held from 11 to 13 November 2018 in Compiegne, with the final day of November 14 in Paris. The Congress provided a platform for learning from some of the world leading specialists in numerical methods, coming from engineering disciplines and applied mathematics.

The main idea of this CILAMCE Congress was to examine recent advances in numerical methods in currently most active research domains, with applications to interface and/or interaction of several engineering disciplines. The multi-physics models and methods of this kind are often bridging the phenomena taking place at multiple scales in space and time, which ought to be placed in interaction or accounted for simultaneously in order to provide the most reliable results explanations. This class of problems calls for the development and combination of different modeling tools and computational methods in order to advance the field towards currently relevant industrial applications. A number of different schools have developed in various domains, both in

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Fig. 1 Book of Proceedings CILAMCE 2018, XXXIX in Congress Series
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engineering sciences and mathematics, with sometimes very little or no interaction between them. It was an explicit goal of this CILAMCE Congress to bring all the different communities together, from Brazil and from France, in the truly open scientific spirit, and thus provide a sound basis for a fruitful exchange and cross-fertilization of ideas among them. The result is available in form of CILAMCE 2018 Book of Proceedings (Ibrahimbegovic and Pimenta 2018); see Fig. 1.

2. Selected papers

The Congress topics that were addressed concerned not only ‘classical’ domains of Solid, Structural and Fluid Mechanics, but also a number of currently ‘hot’ domains, such as: Heterogeneous Materials, Complex Structures and Systems, Material and Structure Failures, Adaptive Modeling, Mechanics of Porous Media, Fluid-Structure Interaction, Multi-Phase Flows, Model Reduction, Stochastic Processes, Uncertainty Propagation, Industrial Applications. The selected papers for this special issue are but a few illustration of the ideas discussed during CILAMCE 2018 Congress.

In particular, in their work (Giuntoli *et al*. 2019) have provided a parallel algorithm to solve

large engineering problems based upon numerical homogenization procedure based upon FE2 multi-scale implementation, in application to predicting the behavior of composite materials. The equations are formulated assuming the small deformations solid mechanics approach with non-linear material models, with the uniform strain boundary conditions used for the macro-to-micro transitions.

The contribution from (Rukavina *et al*. 2019) presents a computational procedure for localized failure. Here, the micro-scale is used to describe the details of the behavior of the material where some inelastic mechanisms, like damage or plasticity, including the complete failure with strain localization phenomena involved. Thus, the macro-scale is used to describe an alternative to homogenization methods using the embedded discontinuity element capable of capturing the softening behavior that takes place at the micro-scale. The two scales are coupled by imposing the constraint on the micro-scale displacement field, imposed by the macro-scale displacement.

A couple of papers deal with fluid-structure interaction problems in fractured reservoirs. In particular, (Debossam *et al*. 2019) presents the computational model for numerical simulation of an isothermal single-phase two-component flow in a naturally fractured oil reservoir, taking into account advection and diffusion effects. The discretization of the governing partial differential equations is carried out using the finite difference method, along with implicit and first-order upwind schemes. The resulting discrete system is solved by the conjugate gradient and bi-conjugated gradient stabilized methods.

Similarly, (Heringer *et al*. 2019) propose the computational method for three-dimensional heavy oil flow in a reservoir with well heaters, along with the corresponding heat transfer equation. The governing equations are discretized using the finite volume method, and discrete system is solved by conjugate gradient method.

The final contributions consider some modeling issues in complex systems. Namely, (Bastos *et al*. 2019) present a study that of the dynamic structural behavior influence upon the human comfort levels in a reinforced concrete building, when subjected to nondeterministic wind dynamic loadings, considering the effect of masonry in-fills that can increase the global stiffness of the structural model.

Finally, (Rosa and Neto 2019) study the behavior of welded connections between square hollow section column and I-beam, with emphasis on the assessment of the joint stiffness. They consider both theoretical and numerical models, which are evaluated for different parameters, such as the thickness of the cross section of the column and the sizes of cross section of the beams.

For more details, I invite the readers to carry on with their own explorations, and I wish they be very fruitful. Last but not least, I wish to thank to all the authors of this special issue for contributing to the worthy goal of providing a more lasting impact of CILAMCE 2018 with their full-size papers.

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