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Frontiers in Computing
Lecture Series

Integrated Computational Materials Engineering

Karel Matouš, Ph.D.
College of Engineering Collegiate Associate Professor of Computational Mechanics
Director, Center for Shock Wave-processing of Advanced Reactive Materials (PSAAP II)
University of Notre Dame, Department of Aerospace & Mechanical Engineering

Tuesday, January 10, 2017 ◈ 11 AM
CSF Darwin Room (1007)

Dr. Matouš' interests are in predictive computational science and engineering at multiple spatial and temporal scales, including multi-physics interactions, development of advanced numerical methods, and high-performance parallel computing. His research focuses on the interplay between applied mathematics, computer/computational science, and physics/materials science. He leads a research program in image-based modeling of heterogeneous materials, focusing on co-designed simulations and experiments based on statistical analysis, computational mathematics, and machine learning. Dr. Matouš has authored or co-authored more than 150 journal and/or conference proceedings articles and abstracts. He is a member of ASME (Fellow), SES, USACM, EUROMECH, and IACM and serves as an Associate Editor of the *Journal of Computational Physics* and *International Journal for Multiscale Computational Engineering*. He received his M.S. and Ph.D. in the Theoretical & Applied Mechanics from Czech Technical University (Prague).

With concentrated efforts from the material science community to develop new multifunctional materials using unique processing conditions, the need for modeling tools that accurately describe the physical phenomena at each length scale remains a paramount concern. In his talk, Dr. Matouš will present an image-based (data-driven) multiscale framework for modeling the chemo-thermo-mechanical behavior of heterogeneous materials while capturing the large range of spatial and temporal scales. This integrated computational approach for predicting the behavior of complex heterogeneous systems combines macro- and micro-continuum representations with statistical techniques, nonlinear model reduction, and high-performance computing. He also will detail the strategy for constructing such a complex computational domain that can execute on hundreds of thousands of processing cores with exceptional scaling performance, as well as describe a platform for computational model verification, validation, and uncertainty propagation.

Host: Nathan Baker (nathan.baker@pnnl.gov), ACMD Division Director

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