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ASSESSMENT OF REPRESENTATIVE MATERIAL PROPERTIES OF CERAMIC MATERIALS THROUGH INVERSE ANALYSIS

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Ceramic materials often involve complex constitutive models apt to describe material mechanical behaviour required for accurate numerical simulations. These models can use either micro-mechanical approaches to address crystalline scale or phenomenological approaches by studying the response of representative volume of material. When proper model is selected, the accuracy of simulations rests on quantification of parameters (i.e. material properties) entering into governing equations. The assessment of these properties is done on the basis of experiments. For complex models governed by large number of parameters, such calibration is rather challenging. If the selected experiment be too simple, the parameter quantification results in fitting the response of single experiment, not in the assessment or material representative properties. Systematic way of resolving this difficulty is through the application of inverse analysis, centered on the minimization of discrepancy function designed to quantify the difference between measured quantities and their computed counter parts. Designed discrepancy function thus depends on elevated number of sought parameters, so the inverse problem is typically ill-posed requiring the application of various regularization techniques, with measured quantities carefully selected to ascertain good sensitivity to the parameters. Within this lecture, some methodological novelties related to the above outlined problem will be presented with reference to two engineering problems. The first one concerns the calibration of phenomenological models used to simulate ceramic powder compaction. It will be shown that through inverse analysis identification of parameters can be performed using only data collected from compaction test. The second problem concerns thermally induced micro-cracking observed in porous ceramics employed for diesel particulate filters. A micro mechanical model is developed and numerically implemented to simulate crack initiation and healing, typically observed within these materials when subjected to thermal cycling. By incorporating the developed model with inverse analysis inter-granular fracture toughness of considered ceramic material can be assessed

Biography

Vladimir Buljak has completed his PhD in 2009 from Politecnico di Milano. Upon completion of his PhD, he spent additional two years as Postdoc within the same institution up to 2011. After that, he moved to the University of Belgrade, Mechanical Engineering Faculty, as an Assistant Professor at the Department of Strength of materials from 2016. He became an Associate Professor at the same institution. He is Professor In Charge as Visiting Professor for the course Theory of plasticity at Politecnico di Milano since 2015. He was Visiting Scientist at University of Trento in 2014 and German Federal institute for materials research and testing - BAM at Berlin in 2016. He was Scientist In Charge for University of Belgrade for European FP7-INT project CERMAT2, dealing with advanced ceramic materials. He has published one book and more than 20 papers in reputed journals.

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