DIPARTIMENTO DI INGEGNERIA CIVILE E AMBIENTALE

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SEMINAR ANNOUNCEMENT

Red Room, Building 4A – first floor, Leonardo Campus
Department of Civil and Environmental Engineering
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Compaction of ceramic powders: numerical simulation and material calibration through inverse analysis

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Abstract

The manufacturing of ceramic components is usually based on not fully understood physical processes, relying on empirical assumptions, with production parameters often difficult to control, resulting in significant waste of energy and material. Most ceramic components are produced in two phases: a cold powder compaction phase, followed by a sintering phase. During powder compaction granular material gradually becomes cohesive through a mechanical densification performed at room temperature. Product that comes out of this phase is called a green body, with enough strength to remain intact upon the ejection from the mold. However, usually the micro defects present in green body are affecting local shrinkage during sintering and can cause high inhomogeneity of final product. It is therefore important to accurately model the phase of powder compaction because it determines the overall characteristics of the final product.

Constitutive description of powder compaction is a laborious task as granular material exhibits quite different mechanical behavior than the dense one. Furthermore, the elastic properties of a green body are significantly changing with increasing compaction pressure. The use of complex constitutive models with elasto-plastic coupling makes the numerical implementation challenging since the number of parameters to calibrate grows, while some of them require high pressure experiments for the calibration. By a current praxis the assessment of these parameters is achieved through various destructive tests performed on green bodies. An alternative and advantageous strategy for such calibration is the employment of inverse analysis methodology. Advantages consist of more accurate and more economical transition from experimentally measured quantities to material constitutive parameters, which are of major interest for reliable simulation of compaction process. By adopting this strategy it is possible to completely eliminate the need for performing experiments on a green body.

The purpose of this lecture is to present some of the advancements within the present field, by pointing out limitations of currently applied techniques. Particular emphasis will be given to the employment of inverse analysis methodology for the calibration of constitutive models in a given context. Recently achieved results by our research team considering above-mentioned and related topics will be shown.

Reference: Prof. Giulio Maier (giulio.maier@polimi.it), Prof. Giuseppe Cocchetti (giuseppe.cocchetti@polimi.it)

Biosketch

Dr. Vladimir Buljak was awarded his PhD title in 2011 at the Politecnico di Milano. Since April 2011, he has been working as Assistant Professor at the Faculty of Mechanical Engineering, University of Belgrade.

At the Politecnico di Milano Dr. Buljak is currently in charge of the course *Theory of Plasticity* (2015-2016; 2016-2017).