6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

MULTISCALE IDENTIFICATION OF APPARENT ELASTIC PROPERTIES AT MESO-SCALE FOR MATERIALS WITH COMPLEX MICROSTRUCTURE USING EXPERIMENTAL IMAGING MEASUREMENTS

T. Zhang[1], F. Pled[1] and C. Desceliers[1]

[1] Université Paris-Est, Laboratoire Modélisation et Simulation Multi Echelle, MSME UMR 8208 CNRS, 5 bd Descartes, 77454 Marne-la-Vallée, France, {tianyu.zhang, christophe.desceliers, florent.pled, christian.soize}@univ-paris-est.fr, http://www.msme.u-pem.fr/

Keywords: *Elasticity tensor, Random field, Multiscale experimental identification, Digital image correlation, Statistical inverse method*

This work deals with complex materials to be modeled with respect to their complexity level at the micro-scale. Despite that at macro-scale, these materials are often modeled as homogeneous elastic media for which the effective mechanical properties can be identified using experimental tests, they are not only heterogenous and random at micro-scale but they often also cannot be properly described in terms of mechanical constituents. This is the reason why a meso-scale is considered and for which the elastic medium is modeled with apparent properties represented by a non-Gaussian tensor-valued random field.

A general methodology using displacement field measurements at both macro- and meso-scales has been proposed in [2] for the identification of an *ad hoc* probabilistic model of the tensor-valued random field [1] modeling the apparent elastic properties at meso-scale. Such a multiscale identification was carried out by setting a statistical inverse problem, requiring an optimization problem to be solved and introducing three indicators for quantifying distances between the experimental measurements and a probabilistic computational model for simulating the experimental measurements. In this work, we present an improvement of this methodology by introducing an additional meso-scale indicator that allows for replacing the global optimization (genetic) algorithm used in [2] by a fixed-point iterative algorithm that drastically reduces the computational cost incurred by the identification procedure.

REFERENCES

[1] C. Soize, Non-gaussian positive-definite matrix-valued random fields for elliptic stochastic partial differential operators. *Computer Methods in Applied Mechanics and Engineering*, Vol. **195**(1), pp. 26–64, 2006.

[2] M-T. Nguyen *et al.*, Multiscale identification of the random elasticity field at mesoscale of a heterogeneous microstructure using multiscale experimental observations. *International Journal for Multiscale Computational Engineering*, Vol. **13**(4), pp. 281–295, 2015.