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

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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.