Homogenization of 3D Concrete Microstructures based on CT image reconstruction

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Abstract

The effective quantification of uncertainty in particle-reinforced composite materials such as concrete, requires the realistic reconstruction of their microstructure. The main sources of uncertainty in this type of composites are the morphology of the reinforcements and their location (random dispersion) inside the matrix. The purpose of this paper is to determine the random spatially varying elastic properties of concrete at various scales taking into account its highly heterogeneous microstructure. The reconstruction of concrete microstructure is based on computed tomography (CT) images of a cubic concrete specimen. The variability of local volume fraction of the constituents (air, cement paste and aggregates) is quantified and mesoscale random fields of the elasticity tensor are computed from a number of statistical volume elements obtained by implementing the moving window technique on the specimen; see Baxter et al. (2001) along with computational homogenization; see Miehe and Koch (2002). Based on the statistical characteristics of the mesoscale random fields, useful conclusions are derived regarding the effect of microstructure on the mechanical behavior of concrete.

References

SC. Baxter, M. Imran Hossain and Li. Graham Micromechanics based random material property fields for particulate reinforced composites. *International journal of solids and structures*, 38:9209–9220, 2001.

C. Miehe and A. Koch Computational micro-to-macro transitions of discretized microstructures undergoing small strains. *Archive of Applied Mechanics*, vol. 72(4-5):300–317, 2002.