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Homogenization of Plain Weave Composites with Imperfect Microstructure

Jan Zeman, Michal Sejnoha

Faculty of Civil Engineering, Czech Technical University in Prague, Prague, Czech Republic

A simple computational framework is presented for the determination of a representative volume element (RVE) of plain weave fabric composites with disordered reinforcement. Although treated as periodic two-phase systems, the imperfect geometry of such materials often precludes a straightforward representation of the RVE in terms of a simple Periodic Unit Cell (PUC). In the present approach, morphology of such material systems is characterized by appropriate statistical descriptors. Then, in order incoprorate microstructure imperfections into selected idealized geometrical model, parameters of the model are found by minimizing the difference between statistical descriptors related to the original microstructure and to the idealized unit cell. Once the parameters are determined, the numerical homogenization method is used to predict the overall response of the composite by the homogenization method. The feasibility of the proposed methodology is verified by its application to artificial material systems to provide guide for modelling of real-world material systems.

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