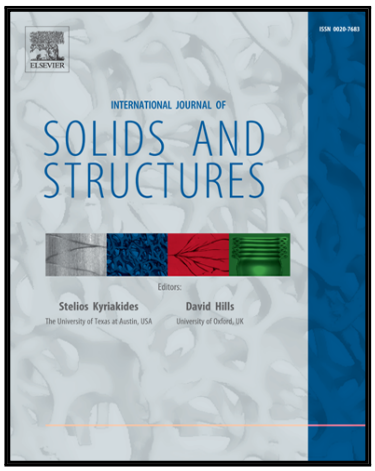

Multiscale Structural Analysis of Textile Composites Using Mechanics of Structure Genome

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Abstract

Mechanics of structure genome (MSG) is used to develop an approach for multiscale structural analysis of textile structures. First, MSG is used to predict the properties of yarns having realistic geometry. Then, beam and plate stiffness matrices are predicted based on the yarn and matrix properties using MSG. These beam and plate stiffness matrices are used to perform structural analysis of textile beams and plates. The computed global responses are used to conduct dehomogenization to obtain local stress fields. The MSG-based global displacement and local stress fields are compared with those predicted by direct numerical simulation (DNS) to compare accuracy and computational efficiency. An excellent agreement was observed for both global displacement and local stress field results, while the computational cost and modeling effort of MSG-based analysis are significantly lower than those of DNS.

Keywords:

Structure genome, Multiscale structural analysis, Textile composites

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