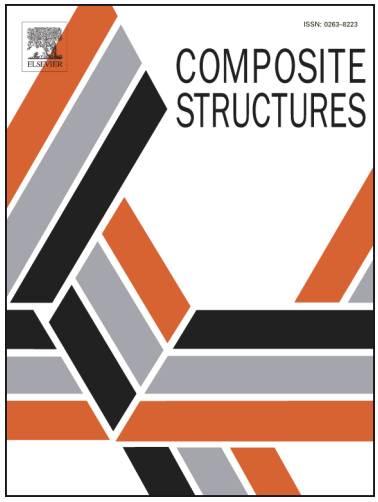


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# Neural network assisted multiscale analysis for the elastic properties prediction of 3D braided composites under uncertainty

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**Abstract**

The stiffness prediction of textile composites has been studied intensively over the last 20 years. It is the complex yarn architecture that adds exceptional properties but also requires computationally expensive methods for the accurate solution of the homogenization problem. Braided composites are of special interest for the aerospace and automotive industry and have thus drawn the attention of many researchers, studying and developing analytical and numerical methods for the extraction of the effective elastic properties. This paper intends to study the effect of uncertainties caused by the automated manufacturing procedure, to the elastic behavior of braided composites. In this direction, a fast FEM-based multiscale algorithm is proposed, allowing for uncertainty introduction and response variability calculation of the macro-scale properties of 3D braided composites, within a Monte Carlo framework. Artificial neural networks are used to reduce the computational effort even more, since they allow for rapid generation of large samples when trained. With this approach it is feasible to apply a variance-based global sensitivity analysis in order to identify the most crucial uncertain parameters through the costly Sobol indices. The proposed method is straightforward, quite accurate and highlights the importance

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