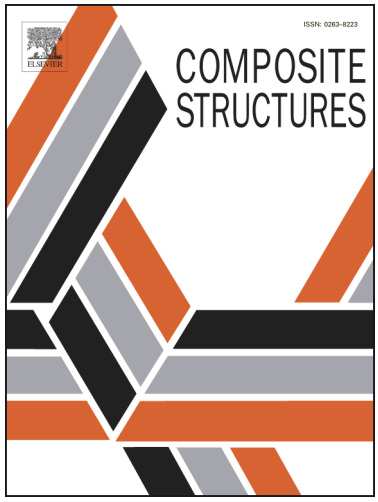

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Influence of stochastic variations in manufacturing defects on the mechanical performance of textile composites

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Abstract

This paper presents a methodology to evaluate the effects of microscopic manufacturing defects, namely fibre misalignment, waviness and volume fraction, on the mechanical performance. Influences of these defects on the effective elastic properties of composites are quantified by a dual homogenization method. For estimating stochastic characteristics of the properties induced by the variations in these defects, a probabilistic extension of the dual homogenization method is developed and numerically implemented through a perturbation-based stochastic finite element method. It is further incorporated in a multiscale finite element based reliability method to measure the influences of these manufacturing defects on structural performance in terms of reliability. The effectiveness of the proposed method in capturing defects is illustrated initially by investigating the effective elastic properties of a unidirectional fibre composite based yarn and then a plain woven textile

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