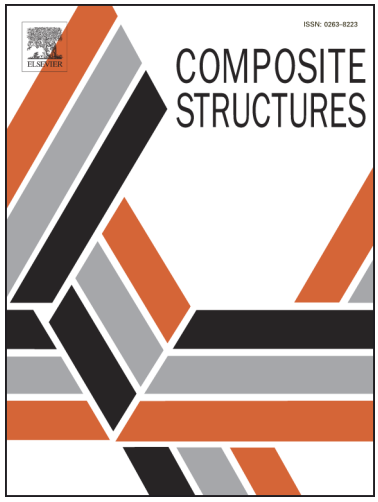

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Representative volume element for composites reinforced by spatially randomly distributed discontinuous fibers and its applications

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Abstract

Combining with the random sequential absorption (RSA) algorithms, the method entitled *Fiber Growth Method* is presented for generating the representative volume element (RVE) with the spatially randomly distributed discontinuous fibers and with a relatively high fiber volume fraction ($\sim$ 25%). The formulation of the *Axes Distance Method* for checking the overlapping of fibers in the RVEs is discussed. Within the framework of elasticity, the generated RVEs are analyzed to obtain the effective mechanical properties of composites reinforced by spatially randomly distributed discontinuous fibers using the numerical homogenization technique based on the finite element analysis (FEA). The validation is performed by comparing the Bulk modulus and Shear modulus predicted by the FEA against those obtained from the traditional equations based on the Halpin-Tsai estimation. FEA results show that due to the spatial random distribution of fibers, composites behaves homogeneously isotropic at the macroscopic scale. Bulk moduli and Shear moduli of composites increase with the fiber volume fraction increasing while the Possion's ratios of composites decrease.

Keywords: Short-fiber composites; Fiber Growth Method; Finite element analysis (FEA); Representative volume element (RVE); Numerical homogenization

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