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Nonlocal Effects in Micromechanics of Functionally Graded Composites of Random Structure

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A general non-local integral equation involving the statistical averages of stresses in the composite and inclusions of random structure functionally graded composite is obtained in the framework of multiparticle effective field method (see Buryachenko, Appl. Mech. Review 2001, 54(1), 1-47). The particular cases of the nonlocal integral equation were solved by three different methods: the quadrature method, the iteration method, and the Fourier transform method with subsequent comparative analysis. The different nonlocal effects are detected; some of them are fundamentally new. The method also allows one to estimate the second moment of stresses in the constituents as well as at each point on the interface between the matrix and fibers, which is used for the prediction of the effective envelope for failure initiation.

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