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MICROMECHANICAL MODELING OF RANDOM COMPOSITES WITH IRREGULARLY SHAPED INHOMOGENEITIES

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ABSTRACT

A micromechanical procedure to predict the effective elastic properties of statistically homogeneous composites is presented. It is assumed that composite consists of matrix material reinforced or weakened by irregularly shaped inclusions or pores. Both isotropic and anisotropic material response is considered. Several first-order micromechanical models are reformulated in terms of the inclusion compliance contribution tensor (H-tensor). This tensor is a convenient tool to evaluate contribution of arbitrarily shaped inclusions to the overall composite properties [1, 2].

In the case of two-dimensional composites, an efficient computational procedure is developed to evaluate H-tensor of irregularly shaped inclusions or pores. This procedure is based on the numerical conformal mapping and Kolosov-Muskhelishvili method. The expressions for H-tensors and effective properties of the composite are found for various inclusion/hole geometries and compared with available analytical solutions.

The approach is illustrated by two-dimensional and three-dimensional micromechanical modeling of the chemical vapor infiltrated carbon-carbon composites [3, 4].

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