Three-component discretely-fibrous composites under matrix microdamaging

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In the present paper a model for the nonlinear deformations in stochastic composites under microdamaging is developed for three-component composites providing that the microdamage is accumulated in the matrix. The composite is treated as an isotropic matrix strengthened by two different types of spheroidal inclusions with transversally-isotropic symmetry of elastic properties. It is assumed that the loading process leads to accumulation of damage in the matrix. Fractured microvolumes are modeled by a system of randomly distributed quasispherical pores. The porosity balance equation and relations for determining the effective elastic modules for the case of transversally-isotropic components are taken as basic relations. The fracture criterion is assumed to be given as the limit value of the intensity of average shear stresses occurring in the undamaged part of the material. Based on the analytical and numerical approach the algorithm for determination of nonlinear deformative properties of such a material is constructed. The nonlinearity of composite deformations is caused by finiteness of component deformations. Using the numerical solution, the nonlinear stress-strain diagrams for three-component concrete for the case of uniaxial tension are obtained.