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Determination of Effective Characteristics of a Fibrous Composite with Account of Viscoelastic Deformation of its Components

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A technique for determination of viscoelastic characteristics of transversal-isotropic fiber composite with isotropic components – viscoelastic matrix and elastic fiber – is proposed. The composite unit cell consisting of two infinite coaxial cylinders is investigated by the representative element method. The solid and hollow cylinders are used to simulate the fiber and matrix, respectively. Characteristics of isotropic components of the composite are expressed through the bulk and shear moduli. The viscoelastic properties of the matrix and the homogenized composite are modeled by integral ratios of the hereditary Volterra theory. The Laplace transform is used to find the components of the axisymmetric stress-strain state of the cell and its components under uniform longitudinal tension. This makes it possible to replace integral operators by algebraic functions. The effective rheological characteristics of a transversal-isotropic viscoelastic composite are determined by fitting displacements of a representative element of the viscoelastic composite and its components.

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