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М.В. Шитикова

НЕКОТОРЫЕ МАТЕМАТИЧЕСКИЕ МОДЕЛИ ВЯЗКОУПРУГИХ АУКСЕТИКОВ

Воронежский государственный технический университет, г. Воронеж, Россия

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Abstract. Nowadays material engineers are looking for the methods rising operating characteristics of traditional materials via creating the structures possessing essential abnormal deformational features. Materials with negative Poisson's ratios which are capable to extend (contract) in the direction perpendicular to the direction of their extension (contraction) belong to such abnormal materials and they are called "auxetics". There are a lot of papers devoted to auxetic materials, however, the majority of them are dealing with the internal structure of auxetics, experimental determination of Poisson's ratios, as well as with the description of features of different auxetics. The papers discussing the mathematical models describing the behavior of viscoelastic auxetics are rare, and there are practically no studies devoted to the solution of boundary-value dynamic problems with such materials. Two viscoelastic models are studied for the cases when the shear and bulk operators are set in terms of the simplest fractional derivative Kelvin–Voigt and Maxwell models. Using the algebra of dimensionless Rabotnov fractional operators it is shown that materials described by such models are viscoelastic auxetics, because Poisson's ratios of such materials are time-dependent operators which could take on both positive and negative magnitudes. It has been found that if the shear and bulk operators of the material are governed by the fractional derivative Kelvin–Voigt model, then such a material, being at the initial moment the auxetic, loses with time its auxetic properties and becomes the ordinary material with a positive Poisson's ratio. But when the shear and bulk operators of the material are determined by the fractional derivative Maxwell model, then at the initial moment such a material possesses the positive magnitude of the Poisson's ratio, and with time it loses conventional properties and become an auxetic material with the negative magnitudes of the Poisson's ratio.