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Performance characteristics of radially poled piezoelectric fiber in viscoelastic matrix composite structures

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Piezoelectric composite structures are widely used as components of adaptive structures due to their superior sensing and actuating capabilities. Such composites are usually made of piezoelectric fibers embedded in an elastic matrix, and for damping application, the fibers are embedded in a viscoelastic matrix. The micromechanical modeling of piezoelectric composites aims to find a coupled multiphysics static solution when the matrix is elastic, while the solution is frequency dependent for a viscoelastic matrix. Many research works related to the piezoelectric fiber composite have been published, both for elastic and viscoelastic composite matrix. However, the work published so far considered only piezoelectric fibers poled in the fiber direction. In this work, the michomechanical model for a radially poled piezoelectric fiber in a viscoelastci matrix will be formulated and numerically solved using the finite element method. The full set of the homogenized electromechanical properties of the composite will be determined. The stiffness and damping characteristics of the composite will be studied and compared with the common case where the piezoelectric fibers are poled in the fiber direction.

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