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8. Analysis

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Stress Analysis In a Spinning Cylinder of Nonlinear Viscoelastic Material Under Internal Pressure

The problem of a compressible, hollow circular viscoelastic cylinder encased in and bonded to an elastic cylinderical shell has been studied, first, by Woodward and Radok (1955) for linearly viscoelastic material by applying Laplace transformation method. Then by Rogers, Lee and Marland (1960, 1964). Also for nonlinear viscoelastic material by using approximated constitutive equation for small finite deformation and short time range which derived from Pipkins third-order theory for incompressible materials. In 1975 Darwish constructed some kernel functions, for relaxation and creep for some materials (like polyurethane, polyvinile-chroroid and polycorbonate) in using the principale cubic theory of nonlinear viscoelasticity of A. A. Illyushin (1970), and the experimental data obtained and presented by W. N. Findley and others (1963-1970).
In this paper stress analysis for nonlinear viscoelastic cylinder under internal applied pressure distributions is presented. The solution of the problem is obtained as the nonlinear convolution integral equation that seems difficult to solve analytically. Two important special cases: (i) compressible nonlinear viscoelastic cylinder and (ii) incompressible nonlinear viscoelastic cylinder are discussed. In both cases, the resulting nonlinear integral equations are numerically solved and the solutions are shown in several figures, and discussed.