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Deformation Analysis of Inflated Cylindrical Membrane of Composite Material with Rubber Matrix Reinforced by Cords

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In the paper an orthotropic hyperelastic constitutive model is proposed which can be applied to numerical simulation for the response of the nonlinear anisotropic hyperelastic material of the air-spring sheet used in inhibitive vibration of driver's seat and of the biological soft tissue. The strain energy function defining the constitutive behavior of orthotropic hyperelastic material is expressed with regard to the assumed material symmetry. The parameters of strain energy function are fitted to the experimental results by the nonlinear least squares method. The deformed shape of the air-spring surface is measured from the photographic records of the grid points drawn on the cylindrical surface of the air-spring used in experimental measures. The stress tensor is calculated from the non-linear membrane theory. The deformation field of inflated cylindrical membrane of air-spring sheet is calculated by solving the system of five first-order ordinary differential equations with the material constitutive law and proper boundary conditions. The finite element method (FEM) was used to simulate deformed process of inflated cylindrical membrane of air-spring sheet. Stability analysis is carried out in finite element analysis (FEA) to detect limit points by arc-length method.

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