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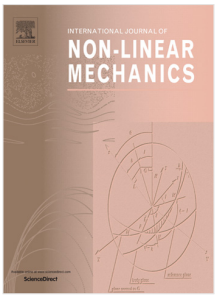

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Nonlinear vibration of axially accelerating hyperelastic beams

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Abstract

This paper investigates principal parametric resonance of axially accelerating hyperelastic beam. Hyperelasticity is integrated into axially moving material for the first time. Based on the continuum mechanics theory, the coupled nonlinear partial differential equations of motion are derived from the extended Hamilton's principle. The model equations are simplified into a single integro-differential equation, which governs the transverse vibration of the hyperelastic beam. The method of multiple scales is used to solve the integro-differential equation to obtain the nonlinear response of the principal parametric resonance. The effect of the the material parameter(i.e. in plane Poisson's ratio) on the type of the nonlinear vibration behavior and amplitude of the nontrivial solutions of steady-state have been investigated. Further, the couple nonlinear governing equations are solved by Galerkin's method. Comparison between the analytical results and the results of the Galerkin's method are made and good agreement are found.

Keywords: hyperelastic beam, continuum mechanics, parametric resonance, Galerkin method, frequency response

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