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Nonlinear Dynamics of Axially Moving Viscoelastic Strings Based on Translating Eigenfunctions

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Nonlinear dynamics is investigated for transverse vibration of axially moving strings. The Kelvin viscoelastic model is chosen to describe the viscoelastic property of the string material. The tension is characterized as a small periodic perturbation on a constant mean value. The translating string eigenfunctions are employed to discretize the governing equation, a nonlinear partial differential equation. By use of the Poincaré maps, the dynamical behaviors are identified based on the numerical solutions of the ordinary differential equations that define respectively the 1, 2, 3 and 4-term truncated systems. The bifurcation diagrams are calculated in the case the dynamic viscosity is varied while other parameters are fixed. The bifurcation diagrams of 1, 2, 3 and 4-term truncated systems are qualitatively same. The numerical results indicate that chaos occurs for the small dynamic viscosity, and regular and chaotic motions alternately appear for the increasing dynamic viscosity.

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