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Non-Linear Vibration and Stability Analysis of an Axially Moving Beam with Rotating-Prismatic Joint

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Abstract : In this paper, the dynamic modeling of a single-link flexible beam with a tip mass is given by using Hamilton's principle. The link has been rotational and translational motion and it was assumed that the beam is moving with a harmonic velocity about a constant mean velocity. Non-linearity has been introduced by including the non-linear strain to the analysis. Dynamic model is obtained by Euler-Bernoulli beam assumption and modal expansion method. Also, the effects of rotary inertia, axial force, and associated boundary conditions of the dynamic model were analyzed. Since the complex boundary value problem cannot be solved analytically, the multiple scale method is utilized to obtain an approximate solution. Finally, the effects of several conditions on the differences among the behavior of the non-linear term, mean velocity on natural frequencies and the system stability are discussed.

Keywords : non-linear vibration, stability, axially moving beam, bifurcation, multiple scales method
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