

Dynamics of Beck's Column via Nonlinear Normal Modes

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The present work deals with the nonlinear dynamics of the column of Beck under a partial follower loading at its tip, characterised by a non-conservativeness parameter η . In the context of Elastica and assuming inextensionality, the beam's motion is governed by a strongly nonlinear integro-differential equation with respect to the cross-sectional rotation $\theta(x,t)$. In order to capture all nonlinear phenomena associated with the motion in both divergence and flutter regimes, this equation is discretized using a two-mode generalized Galerkin approach, in which the spatial functions are nonlinear normal modes satisfying all the boundary conditions. In doing this and after numerous symbolic manipulations the equation of motion is reduced to a set of two second order differential equations with respect to the time functions. These are solved numerically and the corresponding behaviour in both regions of existence and non-existence of adjacent equilibria, i.e. divergent motion or limit cycles (flutter) are assessed.

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