

Postbuckling of beam subjected to intermediate follower force

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Abstract:

This paper investigates the postbuckling behavior of a simple beam under an intermediate follower force acting in the tangential direction to the centroidal axis of the beam. One end of the beam is pinned, while the other end is attached to a roller support. Two approaches have been used in this study. The first approach is based on the elastica theory. The governing equations are derived and solved analytically for the exact closed form solutions that include the equilibrium configurations of the beam, equilibrium paths, and bending moment distribution of the beam. The exact solutions take the form of elliptic integrals of the first and second kinds. In the second approach, the shooting method is employed to solve a set of nonlinear differential equations with the boundary and intermediate conditions. The equations are integrated by using the Runge-Kutta algorithm. The error norms of the end and intermediate conditions are minimized to within a prescribed tolerance error. A comparison study between the analytical elliptic integral solutions and the numerical shooting method solutions show excellent agreement of results. Special features of the solutions are also highlighted.

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