

Postbuckling Behavior and Imperfection Sensitivity of an Elastic Compressible Rod whose Flexural Resistance Changes with Load

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This paper is concerned with the nonlinear behavior and imperfection sensitivity of a compressible elastic column whose flexural resistance changes with load [1-7]. A two-degree-of-freedom model of the column is analyzed. Imperfection is introduced into the system by assuming an initial rotation. Various types of load-stiffness relationships are considered. Post-buckling behavior under static unidirectional loads is investigated. Singularities of the equilibrium path of the column are classified according to the slenderness ratio of the column and the load-stiffness relationship of its support. It is shown that by including the compressibility, imperfections and stiffening of the supports, we can predict the buckling load of the column more accurately. It is also shown that the buckling load can be corrected by means of coefficients obtained from specific diagrams. Using a nonlinear finite element technique, numerical examples, illustrating the imperfection sensitivity of an elastic column in various ranges of slenderness ratios are also given. The results are qualitatively compared with those of a two-degree-of-freedom model.

Key Words: Geometric imperfection, Compressible column, Postbuckling behavior of a column, Euler load, Trifurcation point.

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