LARGE DEFLECTIONS OF BUCKLED COMPOUND CANTILEVER COLUMNS UNDER LINEARLY VARYING LOAD BY USING GALERKIN FINITE ELEMENT FORMULATION

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Abstract

The large deflections of a compound cantilever column (the Elastica), subjected to a linearly varying axial compressive load is investigated. The compound column consists of two segments of different materials, in its half lengths. The Young's modulii of the material of the segments of the column nearer to the clamped and free ends are E_1 and E_2 respectively. The advantages of using the compound cantilever column and its production techniques are presented. The solution of the nonlinear differential equation of the problem, in the Cartesian coordinate system is complex and hence the simpler θ-S system is used. The Galerkin finite element formulation is used to obtain the solution of the Elastica problem, highlighting the difficulty in the assembly of the relevant matrices with traditional degrees of freedom. The numerical results for uniform cantilever columns, when compared with the other solutions, match very well. The same for the compound cantilever columns are acceptable, as these do not violate any physical principles and logical reasoning.

Keywords: Large Deflection Buckling, Compound Cantilever Column, Elastica, Linearly Varying Axial Compressive Load, Galerkin Finite Element Formulation, Eigenvalue Problem, Iterative Solution