
Explicit analysis of a planar Timoshenko beam : Pure shear follower load example

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Abstract

Analytical solutions of a plane, quasi-static but large transformation of a Timoshenko beam are exposed. The problem is first reformulated as a Cauchy initial value problem, where the load (force and moment) is prescribed at one end, and the kinematics (translation and rotation) at the other.

Within this framework, explicit solutions are derived for arbitrary loads. The existence, uniqueness, and regularity of the solutions are rigorously proven.

Analytical post-buckling solutions are obtained, characterized by different regimes explicitly governed by two invariants of the problem. A case of pure shear follower load is studied, with explicit solutions expressed in terms of kinematical and dynamical variables. Both qualitative and quantitative analyses are provided.

Perturbation of the problem is presented in a general way, enabling the computation of perturbed solutions under various boundary conditions.

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