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NUMERICAL METHOD FOR ANALYSIS OF FLEXIBLE CANTILEVER SUBJECTED TO DISTRIBUTED FOLLOWER LOAD

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The static analysis of the flexible rectilinear non-uniform cantilever beam under distributed follower load is considered. The angle of inclination of the load with respect to the deformed axis of the beam remains unchanged during deformation. The mathematical formulation of such a problem yields a boundary value problem for nonlinear integro-differential equation. Usually, the similar non-linear boundary value problem is reduced to a normal system of non-linear differential equations of a fourth order, which is then solved using the shooting method. According to the shooting method, the nonlinear boundary value problem is converted to a set of initial-value problems and the unknown initial value is then determined iteratively. The convergence of this iterative procedure depends upon how close the initial guess values are to the solution sought for.

At the present paper the considered boundary value problem is reduced to an initial value problem by change of variables. As a result, the problem can be solved without iterations by the Runge-Kutta integration scheme. Besides, the solution of initial value problem is unique, i.e. deformed shape is unique for any distributions of flexural stiffness and follower load. It is shown that there exist no critical loads in the Euler sense (divergence). These conclusions generalize the same results for non-uniform cantilever beams under concentrated follower forces [1];[2].

Some equilibrium configurations of the cantilever beam under distributed follower load are presented. The direct numerical method considered is simple, provides high accuracy of calculations, and needs less computational time than the shooting method. The direct method can be extended to similar problems of curved cantilever beams.

REFERENCES

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