Non-linear free vibration of a functionally graded doubly-curved shallow shell of elliptical plan-form

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Abstract :

The non-linear free vibration of a functionally graded doubly-curved shallow shell of elliptical plan-form is investigated using the p-version of the finite element method in conjunction with the blending function method. The effects of transverse shear deformations, rotary inertia, and geometrical non-linearity are taken into account. It is assumed that the material properties vary through the thickness according to a power law distribution. The harmonic balance method is used to derive the equations of free motion. The resultant non-linear equations are solved iteratively using the linearized updated mode method. The efficiency of the method is demonstrated through convergence study and comparison with published results. Three types of functionally graded doubly-curved shallow shells of elliptical plan-form are considered. The effects of the volume fraction exponent and thickness ratio on the linear and non-linear frequencies are discussed. It is shown that these parameters influence the hardening behaviour.

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