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Dynamic Stability of Functionally Graded Plate Under In-Plane Compression

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Functionally graded materials have gained considerable attention in the high temperature applications. With the increased usage of these materials it is also important to understand the dynamics of FGM structures. A study of parametric vibrations of functionally graded plates is presented. Nonlinear moderately large deflection equations taking into account a coupling of in-plane and transverse motions are used. Material properties are graded in the thickness direction of the plate according to volume fraction power law distribution. An oscillating temperature causes generation of in-plane time-dependent forces destabilizing the plane state of the plate equilibrium. The asymptotic stability and almost-sure asymptotic stability criteria involving a damping coefficient and loading parameters are derived using Liapunov's direct method. The energy-like Liapunov functional is constructed as a sum of modified kinetic energy and potential energy of the plate and is written in the form similar to the functional involved in stability analysis of laminated plates. The plates made up of steel and zirkonia as well as made of titanium alloy with SiC fibers are analyzed in details. Effects of power law exponent on the stability domains are studied.

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