Tung, H. V.; **Trang, L. T. N.**

Nonlinear stability of advanced sandwich cylindrical shells comprising porous functionally graded material and carbon nanotube reinforced composite layers under elevated temperature. (English) Zbl 1479.74038

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Summary: The nonlinear stability of sandwich cylindrical shells comprising porous functionally graded material (FGM) and carbon nanotube reinforced composite (CNTRC) layers subjected to uniform temperature rise is investigated. Two sandwich models corresponding to CNTRC and FGM face sheets are proposed. Carbon nanotubes (CNTs) in the CNTRC layer are embedded into a matrix according to functionally graded distributions. The effects of porosity in the FGM and the temperature dependence of properties of all constituent materials are considered. The effective properties of the porous FGM and CNTRC are determined by using the modified and extended versions of a linear mixture rule, respectively. The basic equations governing the stability problem of thin sandwich cylindrical shells are established within the framework of the Donnell shell theory including the von Kármán-Donnell nonlinearity. These equations are solved by using the multi-term analytical solutions and the Galerkin method for simply supported shells. The critical buckling temperatures and postbuckling paths are determined through an iteration procedure. The study reveals that the sandwich shell model with a CNTRC core layer and relatively thin porous FGM face sheets can have the best capacity of thermal load carrying. In addition, unlike the cases of mechanical loads, porosities have beneficial effects on the nonlinear stability of sandwich shells under the thermal load. It is suggested that an appropriate combination of advantages of FGM and CNTRC can result in optimal efficiency for advanced sandwich structures.

MSC:

74G60 Bifurcation and buckling
74K25 Shells
74E30 Composite and mixture properties
74F10 Fluid-solid interactions (including aero- and hydro-elasticity, porosity, etc.)
74F05 Thermal effects in solid mechanics

Keywords:

Donnell shell; reinforced porous functionally graded material; thermal instability; extended linear mixture rule; multi-term analytical solution; Galerkin method

Full Text: DOI

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