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A novel two-dimensional finite element to study the instability phenomena of sandwich plates

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Abstract

This paper presents a two-dimensional finite element model to investigate global and local instability phenomena in sandwich plates. In particular, global buckling and symmetrical and antisymmetrical wrinkling are studied. The classical plate theory is used to model the mechanics of the skins, whereas a higher-order kinematics is adopted for the core. By imposing the continuity of the displacement field at skin/core interfaces and a linear variation of the though-the-thickness shear stresses, a model with nine field variables, resulting 15 degrees of freedom per node is obtained. The weak form of the governing equations is obtained by the principle of virtual work. The equations are discretised by means of the finite element method. The resulting non-linear system is solved by asymptotic numerical method. Several boundary conditions and loads are considered. The presented results are validated towards analytical models and three-dimensional finite element solutions. The numerical investigations show that the assumed kinematics permits to accurately yet efficiently predict the critical load of both global and local buckling as well as the post-bifurcation response.

Keywords: Sandwich plates; Instabilities; Wrinkling; Post-bifurcation response.

1 Introduction

Sandwich structures are composed by two thin and stiff skins separated by a thick, low density and soft core. Besides non-conventional configurations, the faces are, usually,

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