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Static and free vibration analysis of cross-ply laminated plates using the Reissner-mixed variational theorem and the cell based smoothed finite element method

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Abstract

Static bending and free vibration of cross-ply laminated plates with simply supported boundary conditions are studied using layerwise description for field variables. The layerwise approach accounts for the through-the-thickness deformations. The equations of motion and the boundary conditions are obtained by the Carrera's unified formulation. The stiffness matrix is computed by using the Reissner mixed variational theorem (RMVT), in which the transverse stresses are also treated as independent variables apart from the displacements. To this end, a mixed form of Hooke's law is defined. A cell-based smoothed finite element method is employed to compute the terms in the stiffness matrix. The influence of various parameters on the static bending and free vibration are numerically studied.

Keywords: Reissner-mixed variational theorem, laminated plates, vibration, cell based smoothed finite element method, static bending, layerwise theory

1. Introduction

The increased use of engineered materials, commonly referred to as 'composites' in various fields of engineering [1–3], demands clear understanding of their behaviour and

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