

## **Variational approximate for high order bending analysis of laminated composite plates**

By: Madenci, E (Madenci, Emrah)[ 1 ] ; Ozutok, A (Ozutok, Atilla)[ 2 ]

STRUCTURAL ENGINEERING AND MECHANICS

Volume: 73

Issue: 1

Pages: 97-108

DOI: 10.12989/sem.2020.73.1.097

Published: JAN 10 2020

Document Type: Article

### **Abstract**

This study presents a 4 node, 11 DOF/node plate element based on higher order shear deformation theory for lamina composite plates. The theory accounts for parabolic distribution of the transverse shear strain through the thickness of the plate. Differential field equations of composite plates are obtained from energy methods using virtual work principle. Differential field equations of composite plates are obtained from energy methods using virtual work principle. These equations were transformed into the operator form and then transformed into functions with geometric and dynamic boundary conditions with the help of the Gateaux differential method, after determining that they provide the potential condition. Boundary conditions were determined by performing variational operations. By using the mixed finite element method, plate element named HOPLT44 was developed. After coding in FORTRAN computer program, finite element matrices were transformed into system matrices and various analyzes were performed. The current results are verified with those results obtained in the previous work and the new results are presented in tables and graphs.

Keywords

Author Keywords: composite plate; high order shear deformation theory; finite element method; static analysis; energy principle