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Improved thermo-mechanical stress prediction of laminated composite and sandwich plates using Enhanced LCW theory

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Abstract

In this paper, a new analysis method based on the conventional Lo-Christensen-Wu theory (LCW) is proposed to accurately and efficiently predict the thermo-mechanical behavior of laminated composite and sandwich plates. The main objective herein is to systematically modify the strain energy of the conventional LCW theory. To this end, the independent transverse shear stresses are obtained from the fifth-order zigzag model, whereas the displacement fields based on conventional LCW are employed to amplify the benefits of numerical efficiency. The relationships between the two independent fields are systematically derived via the mixed variational theorem (MVT) and the least-square approximation of the mean displacement. The resulting strain energy is referred to as the enhanced Lo-Christensen-Wu theory via the mixed variational theorem (ELCWM). The ELCWM offers the same computational advantage as the conventional LCW while improving upon the accuracy of the local distributions of thermo-mechanical response via a post-processing procedure. To demonstrate the accuracy and efficiency of the proposed theory, the numerical results obtained herein are compared with exact solutions and with data available in the literature.

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