

Residual Stress Analysis in Symmetric Thermoplastic Laminated Plates Under Thermal Loads: Analytic Solution

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ABSTRACT: In this paper, thermal elastic-plastic stress analysis is carried out on simply supported symmetric cross-ply $[0^\circ/90^\circ]_2$ and angle-ply $[15^\circ/-15^\circ]_2$, $[30^\circ/-30^\circ]_2$, $[45^\circ/-45^\circ]_2$, $[60^\circ/-60^\circ]_2$ thermoplastic laminated plates under various temperature change through the thickness of plates. The plates are composed of four orthotropic layers bonded symmetrically. In the solution, a special computer program has been employed. The composite materials are assumed to be strain hardening. The Tsai–Hill Theory is used as a yield criterion. Residual stresses are determined in the symmetric cross-ply and angle-ply laminated plates for small deformations. The intensity of stress components in the symmetric cross-ply laminated plate is higher than in angle-ply laminated plate due to the differences among the stiffnesses of layers. Plastic yielding occurs in all the laminated plate at the same temperature.

KEY WORDS: composite materials, thermoplastic composite, laminated plates, residual stress analysis.

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