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A.V. Duran, N.A. Fasanella, V. Sundararaghavan, A. Waas

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Thermal buckling of composite plates with spatial varying fiber orientations

A. V. Duran[a,**], N. A. Fasanella[1,a,], V. Sundararaghavan[a,*], A. Waas[2,a,]

[a] University of Michigan, 1320 Beal Ave, 3025 FXB building, Ann Arbor, MI 48109, USA

Abstract

Thermal buckling analysis of square composite laminates with variable stiffness properties is presented. Fiber angles vary spatially and result in material properties that are functions of position. The thermal critical buckling temperatures for such laminates are obtained numerically based on classical lamination theory and the finite element method. In this work, the domain is discritized to transform nonlinear fiber path functions to linear piecewise functions. Using this method, thermal responses for symmetric balanced laminates under constant thermal load is investigated and the optimal fiber paths to resist thermal buckling are obtained for multiple material models. The coefficients of thermal expansion are varied to study the effect on the critical buckling temperature and optimal fiber path. Validation for the method presented is achieved using the results for the special case of constant fiber angles found in literature. This work finds curved fiber path configurations that provide a 36.9% increase of resistance to thermal buckling in comparison to straight fiber configurations.

*Corresponding authors: Associate Professor of Aerospace Engineering, Email: veeras@umich.edu

**PhD Candidate, Dept. of Aerospace Engineering, Email: avduran@umich.edu

[1] PhD Candidate, Dept. of Aerospace Engineering, Email: nickfas@umich.edu

[2] Felix Pawlowski Collegiate Professor of Aerospace Engineering, Email: dcw@umich.edu