Accepted Manuscript

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F. Moleiro, V.M. Franco Correia, A.L. Araújo, C.M. Mota Soares, A.J.M. Ferreira, J.N. Reddy

PII: S1359-8368(18)31682-2

DOI: 10.1016/j.compositesb.2018.08.095

Reference: JCOMB 5925

To appear in: *Composites Part B*

Received Date: 26 May 2018

Accepted Date: 23 August 2018

Please cite this article as: Moleiro F, Correia VMF, Araújo AL, Soares CMM, Ferreira AJM, Reddy JN, Deformations and stresses of multilayered plates with embedded functionally graded material layers using a layerwise mixed model, *Composites Part B* (2018), doi: 10.1016/j.compositesb.2018.08.095.

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F. Moleiro[a,*], V.M. Franco Correia[b], A.L. Araújo[a], C.M. Mota Soares[a], A.J.M. Ferreira[c], J.N. Reddy[d]

[a] *LAETA, IDMEC, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais 1, 1049-001 Lisboa, Portugal*
[b] *Escola Superior Náutica Infante D. Henrique, Av. Eng. Bonneville Franco, 2770-058 Paço de Arcos, Portugal*
[c] *INEGI, Faculdade de Engenharia, Universidade do Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal*
[d] *Texas A&M University, College Station, TX 77483-3123,USA*

Abstract

This work presents a new layerwise mixed model for the static analysis of multilayered plates with embedded functionally graded material (FGM) layers subjected to transverse mechanical loads. This model is capable to fully describe a two-constituent metal-ceramic FGM layer continuous variation of material properties in the thickness direction, using any given homogenized method to estimate its effective properties. The present model is based on a mixed least-squares formulation with a layerwise variable description for displacements, transverse stresses and in-plane strains, chosen as independent variables. This mixed formulation ensures that the interlaminar C^0 continuity requirements at the layers interfaces, where the material properties actually change, are fully fulfilled *a priori* for all independent variables. The order of the in-plane two-dimensional finite element approximations and the order of the z-expansion through each layer thickness, as well as the number of layers, whether FGM layers or not, are considered free parameters. The full description of the FGM effective properties is achieved by applying to the z-continuous elastic coefficients a z-expansion through the layer thickness of a given order, set as an added free parameter, in a similar approach to finite element approximations. The numerical results consider both single-layer and multilayered functionally graded plates with different side-to-thickness ratios, using either Mori-Tanaka or the rule of mixtures estimates for the FGM effective properties with different material gradation profiles. The present model results are assessed by

*Corresponding author
Email addresses: filipa.moleiro@tecnico.ulisboa.pt (F. Moleiro), victorfranco@enautica.pt (V.M. Franco Correia), aurelio.araujo@tecnico.ulisboa.pt (A.L. Araújo), cristovao.mota.soares@tecnico.ulisboa.pt (C.M. Mota Soares), ferreira@fe.up.pt (A.J.M. Ferreira), jnreddy@tamu.edu (J.N. Reddy)