

Accepted Manuscript

Geometrically nonlinear thermomechanical analysis of moderately thick functionally graded plates using a local Petrov-Galerkin approach with moving Kriging interpolation

Ping Zhu, L.W. Zhang, K.M. Liew

PII: S0263-8223(13)00398-X

DOI: <http://dx.doi.org/10.1016/j.compstruct.2013.08.001>

Reference: COST 5293

To appear in: *Composite Structures*



Please cite this article as: Zhu, P., Zhang, L.W., Liew, K.M., Geometrically nonlinear thermomechanical analysis of moderately thick functionally graded plates using a local Petrov-Galerkin approach with moving Kriging interpolation, *Composite Structures* (2013), doi: <http://dx.doi.org/10.1016/j.compstruct.2013.08.001>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Geometrically nonlinear thermomechanical analysis of moderately thick functionally graded plates using a local Petrov-Galerkin approach with moving Kriging interpolation

Ping Zhu^a, L.W. Zhang^b, K.M. Liew^{c,*}

^a College of Civil Engineering, Hunan University, 1 South Lushan Road, China

^b College of Information Technology, Shanghai Ocean University, 999 Huchenghuan Road, Shanghai 201306, China

^c Department of Civil and Architectural Engineering, City University of Hong Kong, 83 Tat Chee Avenue, Kowloon, Hong Kong

*Corresponding author, E-mail address: kmliw@cityu.edu.hk

Abstract

A meshless local Petrov-Galerkin approach based on the moving Kriging interpolation technique is developed for geometric nonlinear thermoelastic analysis of functionally graded plates in thermal environments (prescribed a temperature gradient or heat flux). The Kriging interpolation method makes the constructed shape functions possess Kronecker delta function property and thus special techniques for enforcing essential boundary conditions are avoided. In the thermal analysis, the dependency of thermal conductivity of functionally graded materials on temperature is involved, which gives rise to a nonlinear PDE. The nonlinear formulation of large deflection of the functionally graded plates is based on the first-order shear deformation plate theory in the von Kármán sense by taking small strains and moderate rotations into account. The incremental form of nonlinear equations is obtained by Taylor series expansion and the tangent stiffness matrix is explicitly developed in two different ways within the framework of the local meshless method. The nonlinear solutions are computed using the Newton-Raphson iteration method. Parametric and convergence studies are conducted to examine the stability of the proposed method and then several selected numerical examples are presented to demonstrate the accuracy and effectiveness of the method for nonlinear bending problems of functionally graded plates in thermal environments.

Key words: Geometrically nonlinear analysis, thermoelastic, von Kármán strains, Kriging interpolation, Meshless local Petrov-Galerkin (MLPG), Functionally graded plates, Newton-Raphson method, temperature-dependent thermal conductivity.

Download English Version:

<https://daneshyari.com/en/article/6708478>

Download Persian Version:

<https://daneshyari.com/article/6708478>

[Daneshyari.com](https://daneshyari.com)