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Coupled Thermoelasticity of FGM Annular Plate under Lateral Thermal Shock

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Abstract

This study deals with the response of an FGM annular plate under lateral thermal shock load. The equations of motion are obtained using the first order shear deformation plate theory. The governing equations are solved using the Laplace transformation and Galerkin finite element method. Finally, numerical inversion of the Laplace transform is carried out to obtain the results in real time domain. It is shown that coupling coefficient has a damping effect on the radial force resultant and deflection.

Keywords: classic coupled thermoelasticity, annular plate, first order shear deformation plate theory, FGM, thermal shock

1 Introduction

The basic theory and applications of the coupled thermoelasticity problems in mechanics is well discussed and presented in [1] and the methods of solutions are given in [2]. Eslami et al. [3] formulated the coupled thermoelasticity of shell of revolution based on the Flugee second order shell theory with the linear temperature distribution across the shell thickness. The effects of normal stress and coupling term were studied. Bahtui and Eslami [4] studied the coupled thermoelasticity problem of a Titanium–Zirconia functionally graded cylindrical shell under impulsive thermal shock load. The equations were obtained based on the second-order shear deformation shell theory and classic linear theory of thermoelasticity. Temperature distribution across the thickness was assumed to be linear and the results of C^0-continuous and C^1-continuous element types were compared to each other. Babaei et al. [5] presented the finite element solution of FGM beems subjected to lateral thermal shock loads. The results were obtained under coupled thermoelastic and Euler–Bernoulli beam assumption, where the C^1-continuous shape function was employed in the finite element model. Coupled thermoelasticity of constant cross section beam

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