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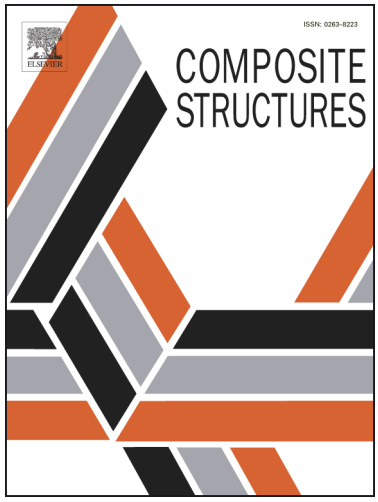

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Forced Vibration Analysis of Functionally Graded Porous Deep Beams

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ABSTRACT

The purpose of this study is to investigate forced vibration analysis of functionally graded porous deep beams under dynamically load. Mechanical properties of the functionally graded deep beam change in the thickness direction with porosity. The beam theories fail to satisfy in the calculation and the boundary conditions of deep beams. So, the plane solid continua model is used in the calculation of deep beams in order to obtain more realistic results. The governing equations of the problems are obtained by using the Hamilton procedure. In the solution of the problem, finite element method is used within the plane solid continua model. The effects of porosity parameters, material distribution and porosity models on the forced vibration responses of functionally graded deep beams are examined and discussed with porosity effects. Numerical results show that porosity plays very important role in the dynamic responses of the functionally graded deep beam. Choosing the suitable functionally graded material distribution, negative effects of the porosity can be decreased. It is necessary to use the plane solid continua model in modelling the deep beams.

Keywords: Forced Vibration; Functionally Graded Materials; Porosity; Deep Beams; Finite Element Method.

1. INTRODUCTION

During the processing in the fabrication of functionally graded materials, it can occur micro-voids and porosities in the material body due to technically problems, curing or poor quality productions. Especially, the part of ceramic in the functionally graded materials occurs voids more frequently. It is known that the porosity is defined a measure of voids, and is a fraction of the volume of voids on the total volume. The volume of voids over the total volume varies between 0 and 1. The porosity is very important issue in the mechanical behavior of structures because materials can lose their strength after a certain porosity ratio. Therefore, understanding the mechanical behavior of structural elements with porosity is importance in designs.

In the present study, the forced vibration of a functionally graded deep beam under dynamically load studied with porosity effect. In the literature, much more attention has been given to the vibration analysis of functionally graded beam structures (Chakraborty et al. [1], Lu and Chen [2], Aydogdu and Taskin [3], Ying et al. [4], Li et al. [5], Azadi [6], Alshorbagy et al. [7], Fallah and Aghdam [8], Şimşek et al. [9], Akgöz and

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