Influences of Dynamic Moving Forces on the Functionally Graded Porous-Nonuniform Beams

Nguyen Dinh Kien[1], Tran Thi Thom[1], Buntara Sthenly Gan[2,*], Bui Van Tuyen[3]

[1]Department of Solid Mechanics, Institute of Mechanics, VAST, Hanoi, Vietnam.
[2]Department of Architecture, College of Engineering, Nihon University, Koriyama, Japan.
[3]Department of Mechanical Engineering, ThuyLoi University, Dong Da, Hanoi, Vietnam.

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Abstract

The dynamic response of functionally graded (FG) porous-nonuniform beams subjected to moving forces is investigated. The beam cross-section is assumed to vary longitudinally in the width direction by a linear or quadratic function. A modified rule of mixture, taking the effect of porosities into account, is adopted in evaluating the effective material properties. Based on Timoshenko beam theory, governing equations of motion are derived from Hamilton's principle, and they are solved by a finite element model. The dynamic response of a simply supported FG porous beam is computed with the aid of the Newmark method. The validation of the derived formulation is confirmed by comparing the obtained numerical results with the data available in the literature. A parametric study is conducted to highlight the effect of the material inhomogeneity, porosity volume fraction, section profile and loading parameters on the dynamic behavior of the beams.

Keywords: functionally graded material, porous-nonuniform beam, porosity, dynamic analysis, finite element model

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*Corresponding author. E-mail address: buntara@arch.ce.nihon-u.ac.jp
Tel.: +81-24-9568375; Fax: +81-24-956-8375

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