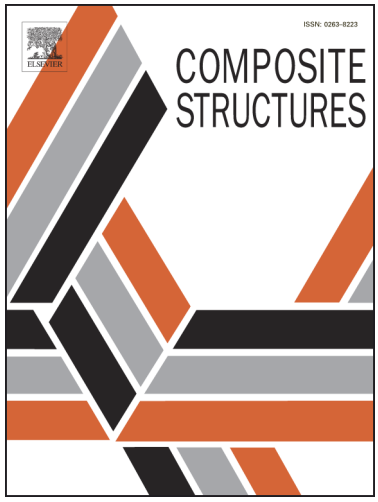

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Differential quadrature method for vibration analysis of electro-rheological sandwich plate with CNT reinforced nanocomposite facesheets subjected to electric field.

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Abstract

In this study, free vibration analysis of smart sandwich plate rested on Winkler-Pasternak foundation is investigated. Sandwich plate is made of electro-rheological (ER) fluid core embedded within two nanocomposite layers which are included ZnO matrix and carbon nanotubes (CNTs) fiber. Due to electrical properties of core and nanocomposite facesheets, the external electric fields are applied to them, separately. The material properties of ER core are determined by Don and Yalcintas models. Also, Eshelby-Mori-Tanaka approach is used to obtain the material properties of nanocomposite facesheets. Hamilton's principle is utilized to derive the governing equations of motion. Numerical characteristics of the differential quadrature method (DQM) are shown through solving selected ER sandwich plate with CCCC and SSSS boundary conditions, core to facesheets thickness ratios, volume fractions of CNTs, external voltage and Winkler-Pasternak foundation coefficients. The results obtained for ER sandwich plate show that DQM has very good accordance with results of finite element method available in literature. Also, it is observed that increasing the volume fraction of CNTs in facesheets leads to increase the stability of ER sandwich plate. These finding can be employed to design building smart structures and machines.

Keywords: Vibration; Sandwich plate; Electro-rheological; Nanocomposite; DQM.

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