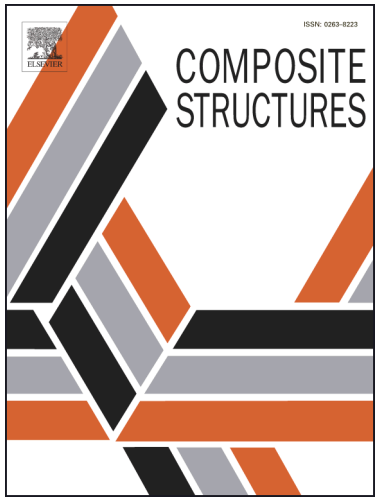

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Isogeometric analysis of functionally graded carbon nanotube reinforced composite nanoplates using modified couple stress theory

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A B S T R A C T

In this paper, we present for the first time a size-dependent model based on the modified couple stress theory (MCST) and isogeometric analysis (IGA) for the static and free vibration behaviors of functionally graded carbon nanotube reinforced composite (FG-CNTRC) nanoplates. By using higher order shear deformation theory for displacement fields, the shear correction factor is omitted when determining the stiffness matrix. Based on the rule of mixture, the effective Young's and shear moduli of carbon nanotube (CNT) are established. For verifying the accuracy and trustworthiness of the proposed method, the present results are compared with those of analytical solutions, and excellent agreement is obtained. The proposed model can capture the small scale effect for FG-CNTRC nanoplates. The effect of length scale on stresses and natural frequencies of FG-CNTRC nanoplates are discussed in details.

Keywords: Isogeometric analysis; Carbon nanotube; Bending; Free vibration; Scale effect; Modified couple stress theory

1. Introduction

Since carbon nanotubes (CNTs) were firstly discovered by Iijima [1], they have drawn much researcher's interests due to their remarkable physical and mechanical properties and have had marvelous possibilities to be new advanced materials [2]. For studying the mechanical properties of CNTs, many researchers paid attention to the analysis of axial compression, bending, torsion and buckling behaviors of single-walled (SWCNT) and multi-walled (MWCNT) carbon nanotubes, e.g. Yakobson et al. [3, 4],