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Vibration analysis of the functionally graded carbon nanotube reinforced composite shallow shells with arbitrary boundary conditions

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ABSTRACT

The aim of this paper is to firstly present the free vibration analysis of functionally graded carbon nanotube reinforced composite (FG-CNTRC) shallow shells with arbitrary boundary conditions. The first-order shear deformation theory and the artificial spring boundary technique are introduced to achieve the general theoretical modeling and arbitrary boundary conditions, respectively. Then according to the energy variational principle, the energy expression of the FG-CNTRC shallow shells is obtained. Furthermore, the admissible displacement functions of the FG-CNTRC shallow shells are chosen as an improved Fourier series which combines the standard double cosine Fourier series and several auxiliary functions which are introduced to remove any potential discontinuity of the displacement function and its derivatives at the edges. In the current framework, the vibration analysis of the FG-CNTRC shallow shells with arbitrary boundary conditions can be conducted by a unified model, and the calculation core code derived from the

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