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Vibration analysis for sector cylindrical shells with bi-directional functionally graded materials and elastically restrained edges

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Abstract

This paper is firstly concerned with natural vibration of sector cylindrical shells with bi-directional functionally graded (BFG) materials and elastically restrained edges by an effective method based on isogeometric analysis (IGA). Effective material properties of longitudinal and circumferential graded materials are obtained by using exponential law and power-law with the mixtures rule. The first order shear deformation theory (FSDT) and a typical IGA cylindrical shells element are introduced to fulfill the vibration investigation. In numerical results, the convergence and accuracy with the current work are validated. Moreover, effects of geometric proprieties, material parameters as well as boundary conditions on the frequencies are also examined. The investigation of results confirms that material properties and radius-length ratio have significant effects on the mechanical behaviors of shells.

Keywords: Natural vibration; Sector cylindrical shells; Bi-directional functionally graded materials; Elastically restrained edges; Isogeometric analysis

1. Introduction

As an advanced engineering composite materials, functionally graded material (FGM)

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