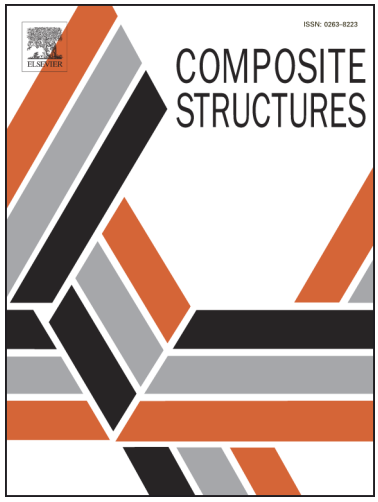

Analytical and numerical method for free vibration of double-axially functionally graded beams

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Analytical and numerical method for free vibration of double-axially functionally graded beams

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ABSTRACT: Free vibration analysis of two different double-beam systems is presented in this article. In both systems, the ends of beams are elastically restrained against translation and rotation. Besides, the beams are interconnected via a mass-spring system. For the double-beam made up of an axially functionally graded beam and a homogeneous beam, a system of three differential equations, including a PDE with variable coefficients, a PDE with constant coefficients and an ODE with constant coefficients is solved. In the second case of two parallel axially functionally graded beams interconnected, a system of three differential equations, including two PDE with variable coefficients and an ODE with constant coefficients is solved. The behavior of the connecting mass-spring system is investigated in detail. Due to the complexity of the studied problem, two different methods are utilized to solve the problem. First, the problem is analytically solved, and closed-form solution is obtained. Second, a finite element solution is found. Comparing the results of both methods with the available ones in the literature shows the accuracy of the proposed methods. The effects of system parameters on the natural frequencies and mode shapes of the system are also found.