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Free vibration analysis of 2D FG plates by a meshfree boundary-domain integral equation method

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Free vibration of two-dimensional (2D) functionally graded (FG) plates with an exponential material gradation is analysed in this paper by a meshfree boundary-domain integral equation method. Based on two-dimensional elasticity theory, boundary-domain integral equations are derived by using elastostatic fundamental solutions. Due to the material inhomogeneity and the inertial effect, two domain integrals emerge in the boundary-domain integral equation formulation. Radial integration method is employed to convert the domain integrals into boundary integrals. A meshfree scheme is achieved through approximating the normalized displacements in the domain integrals by a combination of the radial basis functions and polynomials. Thus, the free vibration problem is reduced into a generalized eigenvalue problem, which involves system matrices with boundary integrals only. By using the present meshfree boundary-domain integral equation method, free vibration of two-dimensional exponentially graded plates with various material gradients, boundary conditions and aspect ratios are investigated, which demonstrates the high convergency, efficiency and accuracy of the present method.

Keywords: free vibration, functionally graded plates, exponential material gradation, boundary element method, meshfree method, boundary-domain integral equations