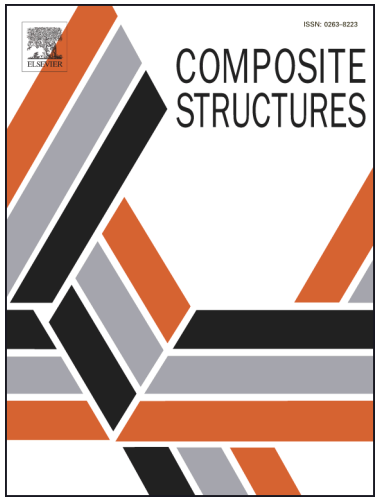

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Isogeometric analysis of size-dependent isotropic and sandwich functionally graded microplates based on modified strain gradient elasticity theory

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ABSTRACT

This paper presents a size-dependent four-unknown shear deformable model for static bending, free vibration and buckling analyses of isotropic and sandwich functionally graded (FG) microplates based on the modified strain gradient theory (MSGT). The MSGT requires three material length scale parameters instead of five parameters as well known in the original strain gradient theory. The material parameters of isotropic and sandwich FG microplates are directly derived from a rule of mixture. The governing equations are derived from the principle of virtual work. Since the present method contains the higher-order gradients in the weak form, NURBS-based isogeometric analysis is suitable for the solution procedure. The effects of geometrical parameters, boundary conditions, volume fraction and material length scale parameters are investigated through isotropic and sandwich FG microplate examples. Obtained results indicate that the consideration of strain gradients leads to a rise of the plate stiffness, and a reduction of displacement and an increase in natural frequency as well as critical buckling load of FG microplates are therefore remarked. Moreover, the present model can be degenerated into the modified couple stress model or classical model when a few material length-sale parameters are neglected.

Keywords: Isogeometric analysis; functionally graded material; modified strain gradient theory; refined plate theory; isotropic and sandwich microplates.

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