

عنوان مقاله:

Geometrically Exact Micropolar Beam Element

محل انتشار:

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خلاصه مقاله:

To investigate inhomogeneity and microstructural effects, micropolar theory (MPT) is one of the well-known generalized continuum mechanic models. Based on MPT, each material particle possesses additional micro-scale rotational degrees of freedoms (DOFs). Developed in this article is a novel three-dimensional (3D) formulation of the micropolar theory which has the capability of being easily used in the finite element analysis (FEA) of fundamental engineering structures. For this purpose, equations of motion, constitutive relations and energy functional of the micropolar continuum are generally derived first. The obtained 3D formulation is then reduced to that based on the geometrically exact beam theory. By including the micro-rotational DOFs, an efficient micropolar element is introduced to accommodate the microstructure character. Consequently, the bending behaviour of micropolar beams with different types of boundary conditions and scale parameters is analysed through the developed FEA. As a result, different comparisons are made between the classical and micropolar models in predicting the bending behaviour of .microbeams

کلمات کلیدی:

Micropolar continuum; Finite element formulation; Geometrically exact beam; Small-scale; Microstructural effects

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