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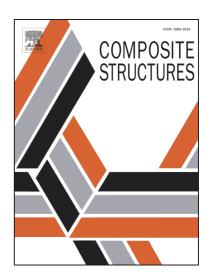
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Flexoelectric effect on the bending and vibration responses of functionally graded piezoelectric

nanobeams based on general modified strain gradient theory

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Abstract

Flexoelectric effect has been defined as the coupling between strain gradient and electric polarization,

however, how to harvest remarkable polarization energy induced by flexoelectric effect is the key

problem. The present work is to study the flexoelectric effect in functionally graded composite

nanostructure with a volume fraction distribution function. And a more general modified strain gradient

theory is used to reformulate the constitutive equations and a more scientific evaluation system is

introduced to measure the electric polarization density field for static bending and free vibration

behaviors of functionally graded piezoelectric nanobeams. Meanwhile, we put forward a new and

simple volume fraction distribution function with two-parameters and the physical surface position for

such nanobeams in which the material properties vary in the thickness direction is determined.

Numerical results indicate that flexoelectric effect can observably influence the electromechanical

response in functionally graded piezoelectric nanobeam at nanometer scale and the pertinent physical

insights are also discussed. And the emerging functionally graded materials are significant and may

help to resolve tantalizing application of flexoelectric effect on practical engineering.

Keywords: Functionally graded piezoelectric nanobeam, Modified strain gradient theory, Flexoelectric

effect, Polarization density field.

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