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Shear buckling of single layer graphene sheets in hygrothermal environment resting on elastic foundation based on different nonlocal strain gradient theories

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Abstract

The influences of temperature, moisture and elastic foundation on the shear buckling of isotropic nanoplates are studied. The size-dependent effects are also investigated. Hence, the refined higher-order plate theories (Polynomial, Exponential, and Hyperbolic) needless of any shear correction factor are used in the formulations. The equations of motion are derived based on the mentioned theories in conjunction with the nonlocal strain gradient theory by Hamilton's principle. The four unknown functions denoting the buckling load of the nanoplate are defined in a modal manner, and Navier solution method is used to find the shear buckling responses. Results for the shear buckling and thermal buckling analysis of nanoplates are approved by existing literature to demonstrate the accuracy of present formulation and solution method. The influence of nanoplate geometry, various hygrothermal conditions, elastic medium, nonlocal parameter and gradient parameter on the shear buckling load by different plate theories are demonstrated. The numerical results indicate that the shear buckling of nanoplate in the absence of strain gradient parameter is significantly affected by the temperature and moisture variations.

Kew words: Shear buckling, Hygrothermal environment, Nonlocal strain gradient theories.

1. Introduction

Among solid carbon-based materials, graphene's due to their superiorities such as low weight to strength ratio, flexibility, large elastic modulus, in-plane stiffness, ultra-high strength, unique chemical, optical and electrical properties have intensely stimulated the interest of the scientific scholar's societies in chemistry, physics, and engineering. The mentioned reasons caused that graphene-based materials to

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