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K.G. Eptaimeros, C. Chr. Koutsoumaris, I.T. Dernikas, Th. Zisis

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Dynamical response of an embedded nanobeam by using nonlocal integral stress models

K.G. Eptaimeros*, C.Chr. Koutsoumaris*, I.T. Dernikas, Th. Zisis

Division of Mechanics
School of Applied Mathematical and Physical Sciences
National Technical University of Athens, Greece

Abstract

An effective tool for investigating the mechanical response of nanostructures is considered the nonlocal continuum theory, capable of explaining the size effect phenomena. The key point of the nonlocal theory is the integral constitutive equation. A transformation of the integral form into the differential one was suggested by Eringen. Applying the nonlocal differential form to structural models, it gives rise to paradoxes and inconsistencies. Previous studies imply this transformation is not a vice-versa process in a finite domain. Recent research suggests that the nonlocal integral constitutive equation, used for the structural models' development, does not give rise to paradoxes and inconsistencies. This work focuses on employing the integral constitutive equation to explore the dynamical response of a nanobeam, embedded in an elastic medium and simulated as a Winkler type elastic foundation, for the first time. In our research endeavor, two models are used, i.e. the two phase nonlocal integral (TPNI) stress model and the modified kernel's model. In particular, the modified kernel, normalized in a finite domain, is employed to dynamical problems for the first time. What is more, both analytical and numerical methods are applied. Based on the results deduced,

*Corresponding authors.
E-mail addresses: keptaim@central.ntua.gr (K.G. Eptaimeros), kkouts@mail.ntua.gr (C.Chr. Koutsoumaris), itdernikas@central.ntua.gr (I.T. Dernikas), zisis@mail.ntua.gr (Th. Zisis)