DEPARTMENT:
Ocean and Mechanical Engineering

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ABSTRACT OF DISSERTATION
Vibration of Nonlocal Carbon Nanotubes and Graphene Nanoplates

This thesis deals with the analytical study of vibration of carbon nanotubes and graphene plates. First, a brief overview of the traditional Bresse-Timoshenko models for thick beams and Uflyand-Mindlin models for thick plates will be conducted. It has been shown in the literature that the conventionally utilized mechanical models overcorrect the shear effect and that of rotary inertia. To improve the situation, two alternative versions of theories of beams and plates are proposed. The first one is derived through the use of equilibrium equations and leads to a truncated governing differential equation in displacement. It is shown, by considering a power series expansion of the displacement, that this is asymptotically consistent at the second order. The second theory is based on slope inertia and results in the truncated equation with an additional sixth order derivative term. Then, these theories will be extended in order to take into account some scale effects such as interatomic interactions that cannot be neglected for nanomaterials. Thus, different approaches will be considered: phenomenological, asymptotic and continualized. The basic principle of continualized models is to build continuous equations starting from discrete equations and by using Taylor series expansions or Padé approximants. For each of the different models derived in this study, the natural frequencies will be determined, analytically when the closed-form solution is available, numerically when the solution n is given through a characteristic equation. The objective of this work is to compare the models and to establish the eventual superiority of a model on others.

BIOGRAPHICAL SKETCH
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