COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

Florian Hache

for the degree of Doctor of Philosophy (Ph.D.)

"Vibration of Nonlocal Carbon Nanotubes and Graphene Nanoplates"

April 4, 2018, 10 a.m.
Engineering West, Room 187
777 Glades Road
Boca Raton, FL

DEPARTMENT:
Ocean and Mechanical Engineering

CHAIRS OF THE CANDIDATE'S PH.D. COMMITTEE:
Isaac Elishakoff, Ph.D. and Noël Challamel, Ph.D.

PH.D. SUPERVISORY COMMITTEE:
Guoqiang Cai, Ph.D.
Manhar Dhanak, Ph.D.
Francisco Presuel-Moreno, Ph.D.

ABSTRACT OF DISSERTATION

Vibration of Nonlocal Carbon Nanotube and Grapheme 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
Born in France
B.S., Lycée Jacques Amyot, Melun, France, 2011
M.S., ISAE-ENSMA, Poitiers, France, 2014
Ph.D., Florida Atlantic University, Boca Raton, Florida, 2018

CONCERNING PERIOD OF PREPARATION
& QUALIFYING EXAMINATION

Time in Preparation: 2015 - 2018

Qualifying Examination Passed: Fall 2015

Published Papers:

Elishakoff, I., Hache, F., Challamel, N., Critical comparison of three versions of Bresse-Timoshenko beam theory for parametric instability, AIAA journal, 56;438-442, 2017.

Elishakoff, I., Hache, F., Challamel, N., Variational derivation of governing differential equations for truncated versions of Bresse-Timoshenko beams, J Sound Vib, In Press, 2017.

Hache, F., Elishakoff, I., Challamel, N., Free vibration analysis of plates taking into account rotary inertia and shear deformation via three alternative theories: a Lévy-type solution, Acta Mechanica, 228;3633-3655, 2017.

Elishakoff, I., Hache, F., Challamel, N., Vibration of asymptotically and variationally based Uflyand-Mindlin plate models, International Journal of Engineering Science, 116;58-73,2017.

Hache, F., Challamel, N., Elishakoff, I., Wang, C.M., Comparison of nonlocal continualization schemes for lattice beams and plate, Arch. Appl. Mech., 87;1105-1138, 2017.

Elishakoff, I., Hache, F., Challamel, N., Critical contrasting of three versions of vibrating Bresse-Timoshenko with a crack, International Journal of Solids and Structures, 109;143-151, 2017.

Challamel, N., Hache, F., Elishakoff, I., Wang, C.M., Buckling and vibrations of microstructured rectangular plates considering phenomenological and lattice-based continuum models, Composite Structures, 149;149-156, 2016.