

# Accepted Manuscript

Oscillation characteristics of carbon nanotori molecules along carbon nanotubes under various system parameters

R. Ansari, F. Sadeghi, S. Ajori

PII: S0997-7538(16)30413-2

DOI: [10.1016/j.euromechsol.2016.11.004](https://doi.org/10.1016/j.euromechsol.2016.11.004)

Reference: EJMSOL 3380

To appear in: *European Journal of Mechanics / A Solids*

Received Date: 7 October 2014

Revised Date: 30 October 2016

Accepted Date: 10 November 2016

Please cite this article as: Ansari, R., Sadeghi, F., Ajori, S., Oscillation characteristics of carbon nanotori molecules along carbon nanotubes under various system parameters, *European Journal of Mechanics / A Solids* (2016), doi: 10.1016/j.euromechsol.2016.11.004.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



# Oscillation characteristics of carbon nanotori molecules along carbon nanotubes under various system parameters

R. Ansari, F. Sadeghi\*, S. Ajori

*Department of Mechanical Engineering, University of Guilan, P.O. Box 3756, Rasht, Iran*

**Abstract.** In this paper, mechanics of carbon nanotori molecules oscillating along the exterior of carbon nanotubes (CNTs) is fully investigated. On the basis of the continuum approximation in conjunction with the 6-12 Lennard-Jones (LJ) potential function, new semi-analytical expressions are given in terms of double integrals to evaluate van der Waals (vdW) potential energy and interaction force between the two interacting molecules. Furthermore, suction energy and acceptance condition, which are the two main characteristics of nanotube-based systems for applications such as drug delivery and so forth, are determined. Using the actual distribution of vdW force, the equation of motion is solved numerically to obtain time-dependent variables of system. Moreover, considering flexible nanotori and CNT molecules, the molecular dynamics (MD) simulations are conducted to assure the validity of the time history of system obtained from the continuum method. A novel semi-analytical expression is also proposed for the precise evaluation of oscillation frequency into which the effects of both geometrical parameters and initial conditions are incorporated. With respect to the present formulation, a comprehensive study into the effect of system parameters on the oscillation frequency is carried out. Numerical results demonstrate that the operating frequency of nanotori-CNT oscillator is in the gigahertz (GHz) range.

**Keywords:** A. Nanostructures

## 1. Introduction

Sparking a significant breakthrough in materials science and nanotechnology has led to the next industrial revolution to begin. Owing to the extraordinary mechanical and electromechanical properties of carbon nanotubes (CNTs) [1], this new class of nanomaterials is identified as the building block of nanotechnology with extensive applications in nanoelectromechanical systems (NEMS) [2, 3]. Amongst

---

Corresponding authors. Tel./fax: +98 13 33690276.  
E-mail addresses: r\_ansari@guilan.ac.ir (R. Ansari), fatemeh\_sadeghi\_64@yahoo.com (F. Sadeghi).

Download English Version:

<https://daneshyari.com/en/article/5014411>

Download Persian Version:

<https://daneshyari.com/article/5014411>

[Daneshyari.com](https://daneshyari.com)