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J.W. Yan, L.H. Tong, Ping Xiang

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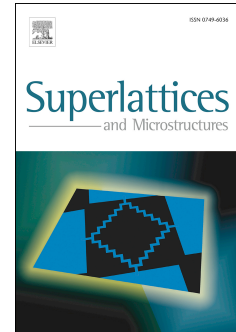
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# Free vibration analysis of single-walled boron nitride nanotubes based on a computational mechanics framework

J.W. Yan<sup>a</sup>, L.H. Tong<sup>b</sup>, Ping Xiang<sup>c, d, e\*</sup>

<sup>a</sup>Key Laboratory of Product Packaging and Logistics of Guangdong Higher Education Institutes, Jinan University, Zhuhai, Guangdong, China

<sup>b</sup>Institute of Geotechnical Engineering, School of Civil Engineering and Architecture, East China Jiaotong University, Nanchang, Jiangxi, PR China

<sup>c</sup>School of Civil Engineering, Central South University, Changsha 410075, Hunan, China

<sup>d</sup>National Engineering Laboratory for High-speed Railway Construction, Changsha, China

<sup>e</sup>Department of Architecture and Civil Engineering, City University of Hong Kong, Kowloon, Hong Kong Special Administrative Region, China

## Abstract

Free vibration behaviors of single-walled boron nitride nanotubes are investigated using a computational mechanics approach. Tersoff-Brenner potential is used to reflect atomic interaction between boron and nitrogen atoms. The higher-order Cauchy-Born rule is employed to establish the constitutive relationship for single-walled boron nitride nanotubes on the basis of higher-order gradient continuum theory. It bridges the gaps between the nanoscale lattice structures with a continuum body. A mesh-free modeling framework is constructed, using the moving Kriging interpolation which automatically satisfies the higher-order continuity, to implement numerical simulation in order to match the higher-order constitutive model. In comparison with conventional atomistic simulation methods, the established atomistic-continuum multi-scale approach possesses advantages in tackling atomic structures with high-accuracy and high-efficiency. Free vibration characteristics of single-walled boron nitride nanotubes with different boundary conditions, tube chiralities, lengths and radii are examined in case studies. In this research, it is pointed out that a critical radius exists for the evaluation of fundamental vibration frequencies of boron nitride nanotubes; opposite trends can be observed prior to and beyond the critical radius. Simulation results are presented and discussed.

**Keywords:** computational framework; single-walled boron nitride nanotubes; higher-order Cauchy-Born rule; free vibration behavior.

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\* Corresponding author. *E-mail address* : [pxiang2-c@my.cityu.edu.hk](mailto:pxiang2-c@my.cityu.edu.hk); [pxiang@csu.edu.cn](mailto:pxiang@csu.edu.cn) (Ping Xiang).

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