### Accepted Manuscript

High Resolution Mass Identification Using Nonlinear Vibrations of Nanoplate

Hassan Askari, Hamed Jamshidifar, Baris Fidan

PII:	S0263-2241(17)30012-X
DOI:	http://dx.doi.org/10.1016/j.measurement.2017.01.012
Reference:	MEASUR 4535
To appear in:	Measurement
Received Date:	11 August 2016
Revised Date:	27 December 2016
Accepted Date:	4 January 2017



Please cite this article as: H. Askari, H. Jamshidifar, B. Fidan, High Resolution Mass Identification Using Nonlinear Vibrations of Nanoplate, *Measurement* (2017), doi: http://dx.doi.org/10.1016/j.measurement.2017.01.012

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.

## ACCEPTED MANUSCRIPT

# High Resolution Mass Identification Using Nonlinear Vibrations of Nanoplate

Hassan Askari<sup>\*</sup>, Hamed Jamshidifar, Baris Fidan

Department of Mechanical and Mechatronics Engineering, University of Waterloo, 200 University Ave. West, Waterloo, ON N2L 3G1, Canada

#### Abstract

This paper investigates nonlinear vibrations of the nanoplates for a high resolution mass identification. As background, the paper is furnished with a succinct review of the applications of the nanoplates, along with recent studies on nanoplate vibrations. In spite of a number of published works related to vibrations of nanoplates, their nonlinear behaviors have not been fully characterized. Accordingly, we present a mathematical model to examine nonlinear vibrations of nanoplates based on the nonlocal theory postulating nonlinear Winkler foundation. Besides, external force is taken into account to scrutinize nanoplate vibrations. The developed mathematical model consists of the assumption of a tiny mass stuck on the nanoplates. Utilizing the Galerkin's method considering multiple scales method provides the primary mode of nanoplate oscillations. In view of that, parametric sensitivity analysis depicts that the frequency response of the nanoplates significantly changes by adding minuscule mass. Two different methods are developed for identification of the added mass. The first method works based on the jump phenomenon in nonlinear oscillators due to the added mass. In the second method, an adaptive parameter identifier estimates the added tiny mass based on a parametric dynamic model of the structure and its vibrational response to a periodic applied force. The effectiveness and straightforwardness of both developed methods are illustrated. Furthermore, a comparison with the molecular dynamics simulation is provided to verify the developed nonlocal model of nanoplate vibrations. It is concluded that the developed method can be considered as consequential and potential tools for high resolution mass sensing. The proposed approaches have the potential to be used in virus, enzyme and also humidity sensing.

Keywords: Nonlinear vibrations, nanoplate, small scale factor, mass sensor

#### Nomenclature

 $\alpha_{om}$  Coefficient of  $\ddot{P}$  with considering mass

Preprint submitted to Measurement

<sup>\*</sup>Corresponding Author

 $Email \ address:$  haskari@uwaterloo.ca (Hassan Askari )

Download English Version:

# https://daneshyari.com/en/article/5006725

Download Persian Version:

https://daneshyari.com/article/5006725

Daneshyari.com