Hassen M Ouakad, J Aeronaut Aerospace Eng 2014, 3:2
http://dx.doi.org/10.4172/2168-9792.S1.005

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Mechanical & Aerospace Engineering
September 08-10, 2014 Hilton Philadelphia Airport, USA

Nonlinear dynamics and vibration of micro and nano systems

Hassen M Ouakad
King Fahd University of Petroleum and Minerals, Kingdom of Saudi Arabia

Few decades have passed by since the discovery and development of micro systems and particularly micro-electro-mechanical systems (MEMS). This technology has reached a level of maturity that, today; several MEMS devices are being used in our everyday life, ranging from accelerometers and pressure sensors in automobilesto inertia sensors in video games. With the increasing demand for sensors and actuators of sophisticated functionalities, which are self-powered, self-calibrated, and self-tested, MEMS are expected to remain the sought-after technology for many years to come. However, with this growing demand come great challenges. Designers are now aiming to achieve complicated objectives while meeting a long list of specifications related to sensitivity, fabrication, system integration, packaging, and reliability. These challenges have created a strong demandto seek new solutions and ideas, beyond changing the geometry of devices and making more complex configurations. There is a need to look into new methods of improvement and innovation in MEMS beyond the static laws of design and the limitations of linear theory. It is realized now that linear theories are too shallow to allow for bolder ideas and more aggressive design goals.Dynamics and motion aspects of MEMS in the nonlinear regimes need to be deeply investigated and explored to reveal new opportunities of novel devices and new functionalities. The past decade has also seen the emergence of Nano-electro-mechanical systems (NEMS) as natural progressions to MEMS, which promise to push the limits of sensitivity and range of operation of devices into new regimes. Thus far however, this technology has not met the initial promise due to many design challenges at the Nano scale, which are mostly related to vibration, dynamics and nonlinearities issues. Numerous strange behaviors and unexplained phenomena have been reported of NEMS-based Carbon nanotubes and Nano-wires, such as their inherent nonlinear behavior even when driven by very small electric loads, low quality factors, detection of unexpected resonances, and unexplained patterns of the dependence of their natural frequencies on the gate voltage. In order to successfully take NEMS from research labs to real-life applications, knowledge about these issues need to be acquired. This talk will discuss some of the ongoing research on the dynamics of Micro and Nano structuresconducted during my doctoral degree and at the micro and nano systems characterization and motion group at King Fahd University of Petroleum and Minerals (KFUPM). The focus of the talk will be on electrically actuated micro and nano systems, which form the backbone of several important classes of devices, such as resonant sensors and band-pass filters. The presentationwill highlightinteresting dynamical aspects of devices rangingfrom mill to Nanoscale. New device concepts based on nonlinear dynamics principles, such hybrid sensors and actuators to detect acceleration and chemical gases, will be discussed.

Biography

Hassen M Ouakad received a BS degree in Mechanical Engineering from Tunisia Polytechnic School in 2007, an MS degree in computational mechanics from a joint graduate program between Virginia Tech and Tunisia polytechnic School in 2008, and a PhD degree in Mechanical Engineering from the State University of New-York (SUNY) at Binghamton, in 2010. He is currently an Assistant Professor at the mechanical engineering department King Fahd University of Petroleum and Minerals (KFUPM) wherehe serves as thedirector of the Micro and Nano Characterization and Motion Laboratory. He has authored and coauthored more than thirty journal and conference publications. He is a recipient of the 2010 SUNY outstanding academic achievement in graduate studies award in theMechanical Engineering Department of the Watson School of Engineering and AppliedSciences. He serves as an Associate Editor for *International Journal of Applied Mechanics and Engineering* (IJAME). He is a member of the American Society of Mechanical Engineers ASME since 2008.

houakad@kfupm.edu.sa