

## RADS Seminar

Speaker: **Mohammad I. Younis**, King Abdullah University of Science and Technology, Saudi Arabia

When: Monday, August 26, 3:00pm – 5:00pm

Where: 310 Kelly Hall

### Smart Dynamic-Based Micro and Nano Devices

Miniature structures and devices have captured the attention of the scientific community for several decades for their unprecedented attractive features. Today, several micro-electro-mechanical systems MEMS devices are being used in our everyday life, ranging from accelerometers and pressure sensors in automobiles, radiofrequency (RF) switches and microphones in cell phones, and inertia sensors in video games. Due to the quest to boost sensitivity, reduce power consumption, and increase integration density, the past two decades have witnessed the emergence of Nano-electro-mechanical systems NEMS. With the increasing demand to embed more intelligence into various applications, MEMS and NEMS continue to play key role on advancing innovation. Along with their great promise, micro and nano devices have brought new challenges and a wide spectrum of unexplained and less-understandable mechanical behaviors and phenomena. Because these devices employ moveable compliant structures and due to the interaction with short-range forces, many of these challenges are related to their dynamical behavior, which is mostly nonlinear. In this talk, we demonstrate that by developing a proper understanding and deep insight into the dynamics and nonlinear mechanics phenomena at the micro and nano scale, new technological solutions and innovative ideas can be realized leading to new generations of superior devices. The talk will first discuss the realization of smart resonant sensing platforms utilizing multi-modal vibration excitation of structures to achieve multiple functionalities. These include boosting sensitivity, compensating for temperature drift, and combining sensing and actuation on a single device. In one application, active switches triggered by the detection of gas will be demonstrated. Toward this, electrostatically actuated microbeams resonators are fabricated, then coated with highly absorbent polymers, metal-organic frameworks (MOFs), and afterward are exposed to gases. Such devices can be useful for instant alarming of toxic gases. The second part of the talk will discuss the intriguing static and dynamic behavior of actively tunable structures; which can be tuned using electrostatic and or/electrothermal actuation. We will discuss the potential of implementing such structures for logic, memory, and filtering applications. The talk will end on future directions and perspectives into bio-sensing applications.



**Bio:** Mohammad I. Younis received a Ph.D. degree in engineering mechanics from Virginia Polytechnic Institute and State University, Blacksburg, VA, in 2004. From 2004-2013 he served as an assistant and then as an associate professor of Mechanical Engineering at the State University of New York (SUNY), Binghamton, NY. In 2013, he moved to King Abdullah University of Science and Technology, Saudi Arabia, where he served as an associate and then full professor of Mechanical Engineering and a Director of the MEMS and NEMS Characterization and Motion Laboratory. Dr. Younis is a recipient of the SUNY Chancellor's Award for Excellence in Scholarship and Creative Activities in 2012, the National Science Foundation Faculty Early Career Development Award in 2009, and the Paul E. Torgersen Graduate Research Excellence

Award in 2002. He holds several U.S. patents in MEMS sensors and actuators. He serves as an Associate Editor of *Nonlinear Dynamics*, *Journal of Computational and Nonlinear Dynamics*, *Journal of Vibration and Control*, and *Meccanica*. He is a member of the American Society of Mechanical Engineers ASME and IEEE.

Host: Oumar Barry

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