Chair of Analogue Circuits and Image Sensors
Universität Siegen

Circuits and Sensors Seminar

Nonlinearities in ultrathin nanoelectromechanical systems

Prof. Dr. Akshay Naik
Associate Professor,
Indian Institute of Sciences, Bangalore

When: 4 pm, Monday the 24th of June, 2019
Where: ***PB-H 0103***

Abstract

All systems are inherently nonlinear. Nevertheless, there is general inclination to treat nonlinearity as an unwanted effect and to design ways to reduce it. While microelectromechanical systems have been around for more than 5 decades, there are very few applications that actively exploit the nonlinearities in these devices. The scaling down of dimension has now produced devices sensitive enough to detect mass of individual molecules. But smaller dimensions also imply faster onset of nonlinearities and thus reduced sensitivities. Yet these nonlinearities receive very little attention in sensor applications. In this talk, I'll talk about our efforts to study these nonlinearities in ultra-thin nanoelectromechanical systems. These include designing ways to manipulate the nonlinearities using electrostatic gate voltages to improve the dynamic range and to observe weak higher order effects that are typically masked by strong lower order nonlinearities. I'll also talk about the interaction between vibrational modes due to linear and nonlinear mode coupling.

Speaker Bio

Prof. Akshay Naik received his Ph.D. in Electrical Engineering from University of Maryland, College Park, in 2006. He then worked at Caltech first as Postdoctoral Associate from 2006 to 2008 and then as Research Engineer from 2008 to 2011. In Dec 2011, he joined the Indian Institute of Science, Bangalore where he is currently an Associate Professor at the Centre for Nano Science and Engineering. His research interests are physics and application of Nano-electromechanical systems.

Further Reference

- "Effect of strain on effective Duffing nonlinearity in CVD-MoS2 resonator", C. Samanta, N. Arora, K. Vaidyuala, S. Raghavan and A. K. Naik, Nanoscale
- "Frequency fluctuations in silicon nanoresonators", M. Sansa, …, Akshay K Naik, … M. L Roukes, G. Jourdan, S. Hentz, Nature Nanotechnology 11, 552–558 (2016)
- "Towards single-molecule nanomechanical mass spectrometry", A. K. Naik, M.S. Hanay, W. K. Hiebert, X. L. Feng and M. L. Roukes. Nature Nanotechnology 4, 445-450 (2009)
- "Cooling a nanomechanical resonator with quantum back-action", A. Naik, O. Buu, M.D. LaHaye, A.D. Armour, A. A. Clerk, M.P.Blencowe and K.C. Schwab. Nature 443, 193-196

For more information, write to acis@eti.uni-siegen.de