MEMS Resonators for Frequency Control and Sensing Applications

This tutorial will review the state-of-the-art in MEMS resonator technology that uses piezoelectric, electrostatic and thermal transduction. Examples of some of the latest micromechanical resonators under development at Universities, National Labs and industry will be provided. Device design, fabrication and performances will be discussed and compared to commercially available resonators such as quartz crystals and surface acoustic wave devices. The utilization of these resonators for frequency control applications such as filtering and high precision signal generation will be presented. In addition, the ability of arraying these devices, fabricating them in large volumes and integrating them with electronics will be emphasized in regards to new opportunities in the area of low power front-ends, channelizers and reconfigurable circuits.

Furthermore, the continuous miniaturization and frequency scaling of the MEMS and NEMS resonator technology has enabled the utilization of these devices for the making of very sensitive, portable and low-power sensor arrays. The tutorial will briefly review some examples of chem/bio resonant detectors from academia and industry, and highlight the advantages that MEMS will bring to this space with respect to currently available solutions.