

Research Proposal

“Performance Enhancement of 3-DoF Non-Resonant MEMS Gyroscope and Verification through Physical and Behavioral Modeling Simulations”

The main purpose of this research will be performance enhancement of a 3-DoF non-resonant MEMS gyroscope (already fabricated). A comprehensive parametric optimization methodology will be developed. Based on the optimization methodology, a new optimized design will be proposed to achieve higher dynamic amplification along with decreased actuation voltages. The model of new proposed optimized design will be developed in Designer Module of CoventorWare. Modal analysis, electrostatic analysis and displacement analysis will be carried out using the Analyzer Module of CoventorWare to verify the new optimized design's performance.

Rate table characterization is the main interest of MEMS gyroscope designers. In order to fully analyze the behavior of the device under the applied rotation, a complete behavioral model of the optimized MEMS gyroscope design will be developed in ARCHITECT Module. It was observed in the case of previously fabricated MEMS gyroscope that there were certain fabrication imperfections using commercially available MetalMUMPs process. Due to these fabrication imperfections the drive and sense mode characterization of previously fabricated MEMS gyroscope showed deviation in modal frequencies as compared to that of the simulated results. A parametric sensitivity analysis will be carried out which will help to understand the behavior of device under different fabrication imperfections. Moreover, since packaging of the device is of major concern for proper functioning of the device, so influence of environmental factors such as temperature and stress on packaging will be analyzed.