Highly Optimised Double Gimbal-Based Accelerometers with Piezoelectric Sensing Mechanism

K. Govardhan[1], T. Pedanekar[1], P. Vashishtha[1]

[1]VIT University, Vellore, Tamil Nadu, India

Abstract

The benefits of low cost, less space occupancy, higher dimensional stability and less manufacturing time has led to the growth in demand of micro scale devices having a varied area of application. Micro-accelerometers are devices which give an account for static and dynamic vibrations and can be piezo-resistive, piezoelectric or capacitive in nature. This paper deals with MEMS based single and dual axis piezoelectric accelerometers. The structure has been optimized from a simple dual beam model to a highly axis sensitive double gimbal model. The beam size and shape have been fine tuned to provide the maximum possible sensitivity. The positioning of the piezo electric pickup has also been optimized to obtain the maximum response for the least possible acceleration.

Reference

1. S. Kal, S. Das, D.K. Maurya, K. Biswas, A. Ravi Sankar, S.K. Lahiri, "CMOS compatible bulk micromachined silicon piezoresistive accelerometer with low off-axis sensitivity", Microelectronics Journal 37 (2006) 22–30
2. Nikhil Bhalla, Sheng Shian Li, Danny Wen Yaw Chung, "Multi-Domain Analysis of SiliconStructures for MEMS based Sensors", 2011 COMSOL Conference, Boston
3. Nikhil Bhalla, Sheng Shian Li, Danny Wen Yaw Chung, "Simulations of MEMS based Piezoresistive Accelerometer Design in COMSOL", 2011 COMSOL Conference, Boston
4. E Jesper Eklund and Andrei M Shkel, "Single-mask fabrication of high-G piezoresistive accelerometers with extended temperature range", Journal of Micromechanics and Microengineering, IOP Publishing, 17 (2007) 730–736
5.Design and Optimization of Highly Sensitive Single Axis Accelerometer Using COMSOL Multiphysics® Kunal A.Kshirsagar Govardhan 1VIT University, Sensor System Technology, School of Electronics Engineering, Vellore, Tamil Nadu, India VIT University, MEMS & Sensor Division, School of Electronics Engineering, Vellore, Tamil Nadu, India
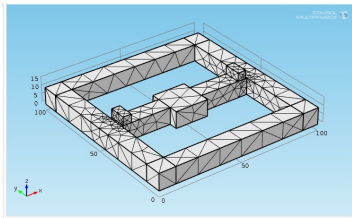
Figures used in the abstract
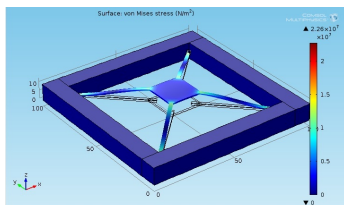

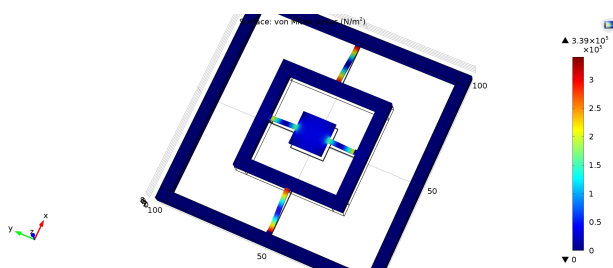**Figure 1**: Single Axis Accelerometer

Figure 2: Dual Axis Accelerometer
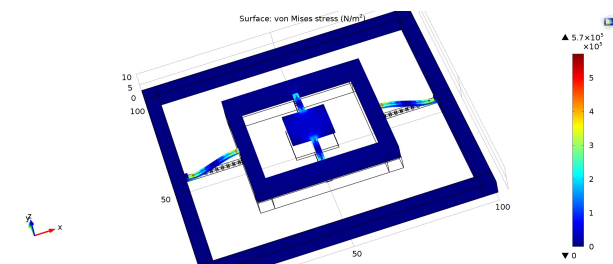

Figure 3: Double Gimbal Accelerometer

Figure 4: Double Gimbal Accelerometer with Flextured Beams