Design and Stimulation of Capacitive Pressure Sensor for Condition Monitoring

K. J. Rudresha[1], S. Sushma[1], R. Surekha[1], S. Swathi[1], S, Singh[1], Dr. S. L. Pinjare[1]

1. Nitte Meenakshi Institute of Technology, Bengaluru, Karnataka, India

Introduction: This poster focuses on the development of a Capacitive Pressure sensor for Condition Monitoring applications. One method to measure vibrations is to mount an pressure sensor on the vibrating machinery or object and measure the pressure exerted due to vibrations. Measured pressure level helps to detect any deviations from the normal conditions.

Sensor design: This design has Z shaped beams on two sides and combs on the other two. There are movable fingers extruding from the both sides of the central (proof) mass. There are fixed fingers on the right and left side of the each movable pillars (p3&p4). The movable fingers form a differential capacitance with left and right comb fingers when the proof mass is displaced, there is a change in capacitance between the electrodes and capacitance is calculated analytically and compared with the obtained results. The capacitance between two parallel plates is given by:

$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

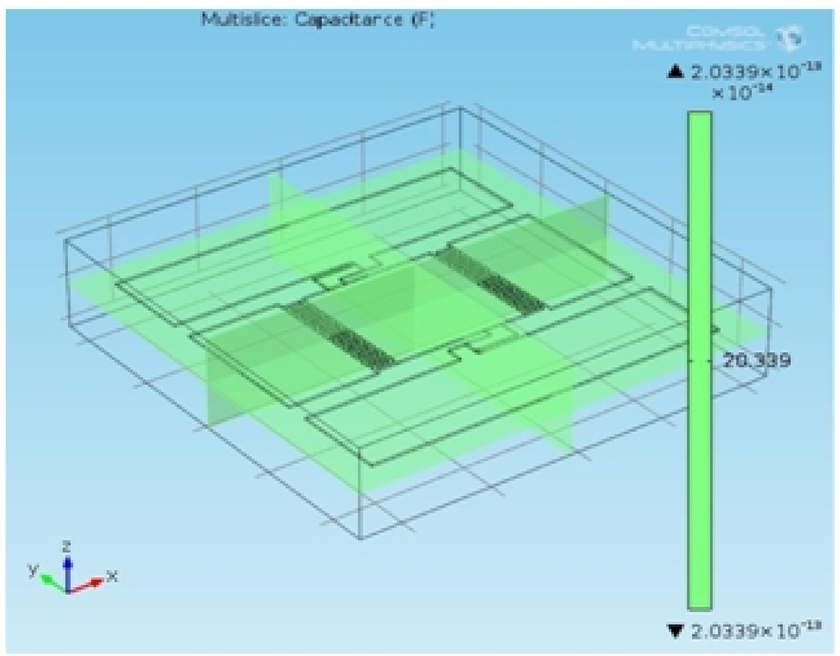

Figure 1. output capacitance

RESULTS

Capacitive analysis: Coupled electro-mechanical simulation is done, by applying a voltage of 5V to the left and right electrodes having the fixed combs and grounding the proof mass.

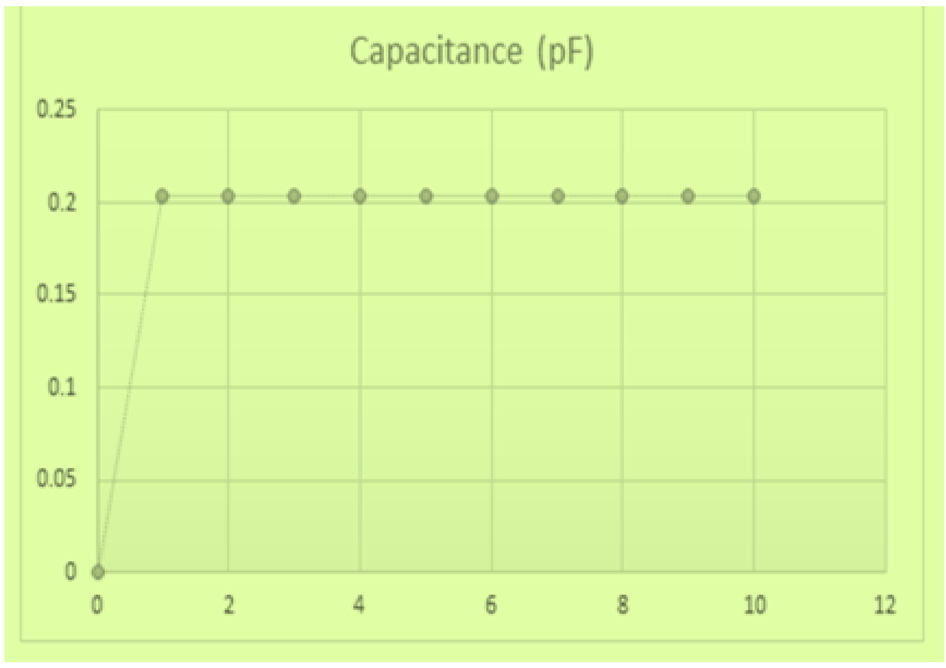

Figure 2. Capacitance vs pressure

Conclusions: MEMS technology based capacitive sensor working up to 1bar pressure and output capacitance of 0.2pF

References:

1. Tolga Kaya, Behrouz Shiari, Kevin Petsch and David Yates, “Design of a MEMS Capacitive Comb-drive Accelerometer”, Central Michigan University, University of Michigan.

2. S. Hegde, Thejas and N Bhat, “Universal capacitance sensor”, Proc. Of ISSS, 2008, Intl. Conference on Smart Materials Structures and Systems, July 2008, Bangalore, India.

3. Jagadeesh Pandiyan1, M. Umapathy2, S Balachandar3, M.Arumugam4 “Design of industrial Vibration Transmitter Using MEMS Accelerometer” Journal of Physics: Conference series 34 (2006), International MEMS Conference 2006.