MEMS-Based Capacitive Pure Bending Strain Sensor

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Abstract

MEMS (Microelectromechanical system) capacitive based pure bending strain sensor is presented for use in monitoring the progress in healing of the knee after injury or after knee replacement. The sensor is designed to monitor the progress in knee bending during physiotherapy. The sensor is designed and simulated in COMSOL Multiphysics® software. The capacitive structure of sensor is composed of two parallel plates with narrow gap between them and conjoint end. The sensor is mounted on the cantilever, which responds to the strain. The dimension of sensor is very small as compared to that of cantilever beam. Therefore, its simulation is a great challenge for us. For simulation, two methods were used. First consists of only simulating the sensor by having the effect of cantilever displacement on it. Second, consists of simulating the cantilever and sensor as the two components in same model. The mechanism of sensing is based on the concept of change in capacitance due to change in gap between capacitor plates. Nine permutation of the design with different metal coverage area and gaps were simulated. The change in capacitance is simulated for different strain range. The simulation is done using electromechanics module and simulated results were compared with the analytic results. Different graph were formed between capacitance v/s strain for different initial gap between plates of capacitor. Gauge factor for different design were compared. Different materials were used for the fabrication of sensor.

Figures used in the abstract

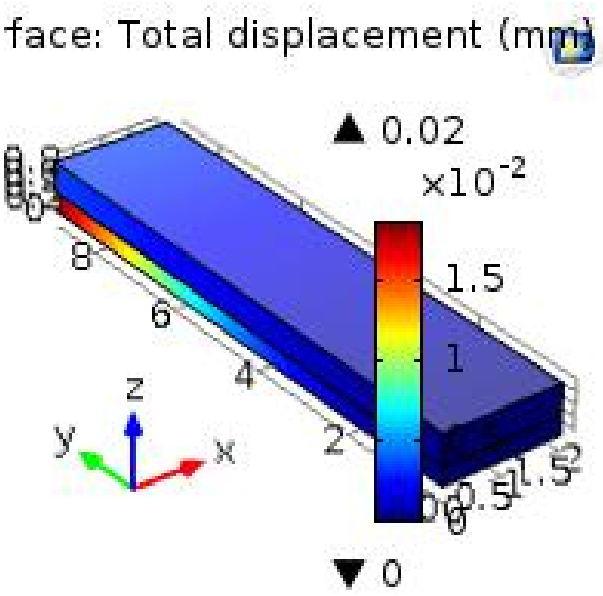

Figure 1: Displacement produced by applied force.