Design And Simulation Of A Microelectromechanical Double-Ended Tuning Fork Strain Gauge

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Abstract

Abstract—Strain gauges have been extensively used for detecting strain in various applications. Double-ended tuning fork (DETF) strain gages present better performance characteristics than standard foil gauges, including higher sensitivity, smaller size and higher resolution. This study focuses on the design of a microelectromechanical (MEMS) double-ended tuning fork (DETF) and the evaluation of its performance through the comparison of analytical and computational model outcomes. The analytical model predicts the frequency and sensitivity of the gauge using the beam equation while the finite element (FEM) computational model is set up using COMSOL. The analytical and the computational models are in fairly good agreement. The designed MEMS strain gauge has a strain sensitivity of 49.8 Hz/με according to the FEM model and 57.7 Hz/με according to the analytical model. The obtained sensitivity is comparable higher than state-of-the-art MEMS gauges using silicon substrate. Our design has the additional advantage of using a 2-mask SOI process resulting in a simpler fabrication process.