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A Micro-Scale of Electromechanical System Micro-Sensor Resonator Based on UNO-Microcontroller for Low Magnetic Field Detection

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Abstract : This paper focuses on the simulation and implementation of a resonator micro-sensor for low magnetic field sensing based on a U-shaped cantilever and piezoresistive configuration, which works based on Lorentz force physical phenomena. The resonance frequency is an important parameter that depends upon the highest response and sensitivity through the frequency domain (frequency response) of any vibrated micro-scale of an electromechanical system (MEMS) device. And it is important to determine the direction of the detected magnetic field. The deflection of the cantilever is considered for vibrated mode with different frequencies in the range of (0 Hz to 7000 Hz); for the purpose of observing the frequency response. A simple electronic circuit-based polysilicon piezoresistors in Wheatstone's bridge configuration are used to transduce the response of the cantilever to electrical measurements at various voltages. Microcontroller-based Arduino program and PROTEUS electronic software are used to analyze the output signals from the sensor. The highest output voltage amplitude of about 4.7 mV is spotted at about 3 kHz of the frequency domain, indicating the highest sensitivity, which can be called resonant sensitivity. Based on the resonant frequency value, the mode of vibration is determined (up-down vibration), and based on that, the vector of the magnetic field is also determined.

Keywords : resonant frequency, sensitivity, Wheatstone bridge, UNO-microcontroller
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