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(Research Article)
Design and fabrication of Fabry-Perot fiber optic sensor with FMCW phase extraction method for acoustic detection implementation

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Abstract

The sensors used to detect acoustic waves were included only electrical and magnetic methods before. But today, more advanced technologies such as micro-electromechanical sensors and fiber optics have been studied to design sensors. In this paper, we are intended to introduce a new sensor based on fiber optic technology, designed and built for implementation in sonars for tracking drones. Among the various types of fiber optic sensors, phase interferometers, especially Fabry-Perot, are the most sensitive. However, their output signals require advanced signal processing due to their interference and nonlinearity. In this paper, the design and fabrication of the Fabry-Perot sensor is discussed which is combined with the diaphragm structure to adjust the frequency response to the common acoustic wave frequency emitted by the drone engine. Digital programs based on the FMCW method have also been developed to process the output signal from this sensor; which can instantly receive information from the sensor. The sensor designed and built in this paper has a significant sensitivity of 6.25 microvolts per pascal after characterization and also shows an SNR of 56 at its operating frequency in case of data collection with the program developed for signal processing.

Keywords: Radar, Sonar, Lidar, Micro-electromechanical sensor, Fiber optic sensor, Fabry-Perot, FMCW.

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