Design and simulation of pressuresensor and accelerometer based on integrated optical circuits using photoelastic effect of LiNbO$_3$

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Abstract

In this paper a novel optical pressure and acceleration sensor based on micro electro mechanical systems (MEOMS) has been designed. For this purpose an integrated Mach-Zander interferometer has been used in LiNbO$_3$ diaphragm. In this sensor, the strain caused by applied pressure or acceleration leads to a change in refractive index of the wave guide in the diaphragm due to the photoelastic effect. The refractive index change leads to a phase change in the light wave that propagates in the waveguide. This phase change is converted to intensity change using the Mach- Zander interferometer. The software ANSYS 14.5 was used for calculation of the strain in the diaphragm. The pressure and acceleration sensitivity of the designed sensor have been obtained $2.33\times10^{-4}$ (rad /Pa) and $2.16\times10^{-5}$ (rad.s$^2$/m), respectively.

Keywords: Micro-Opto-Electro-Mechanical systems (MOEMS), optics, photo-elastic, pressure sensor

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