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Theoretical Analyses and Experimental Evaluation of a Small-Displacement Sensor Based on Surface Plasmon Resonance Technology

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In this paper, a small-displacement sensor based on the surface plasmon resonance technology and heterodyne interferometry is proposed. The basic sensing unit is composed of a prism assembly and a displacement probe. The prism assembly consists of a halfwave ($\lambda/2$) plate, two right-angle prisms with two metal films, and two rotation stages. The small-displacement sensor has high sensitivity and resolution owing to the attenuated total reflection effect in heterodyne interferometry. Additionally, we can obtain the results of the experiment in a distant place by using of a ZigBee module and a USB data acquisition card (DAQ card). It can be seen that the displacement resolution of the small-displacement sensor can reach 0.155 nm. The small-displacement sensor has some merits, such as easy operation, high measurement accuracy, high resolution, and rapid measurement, and its feasibility has been demonstrated.

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