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Improved Small-Angle Sensor Based on Total-Internal Reflection and Surface Plasmon Resonance in Heterodyne Interferometry

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In this paper, an improved small-angle sensor based on total-internal reflection (TIR) and surface plasmon resonance (SPR) in heterodyne interferometry (HI) is proposed. The improved small-angle sensor is designed as a reflective elongated prism made of BK7 glass. The shorter-side surface of the reflective elongated prism was coated with a 2 nm Ti film and a 45.5 nm Au film, but the longer-side surface was not coated with metal films. With the new small-angle sensor, a small rotation angle can be obtained simply by measuring the phase difference between the p-and s-polarization lights owing to the effects of multiple attenuated total reflections (ATRs) and TIRs. Its angular resolution can reach 2.95×10^{-7} rad at least. Moreover, the improved small-angle sensor is very stable because its common optical path is insensitive to environmental disturbances. The improved small-angle sensor has some advantages, such as high resolution, high sensitivity, stability, and real-time testing.

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