

Highly Sensitive Fiber-Optic Curvature Sensor Based on Four Mode Fiber

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Abstract : In this paper, a highly sensitive fiber-optic curvature sensor based on four mode fiber (FMF) is presented and investigated. The proposed sensing structure is constructed by fusing a section of FMF into two standard single mode fibers (SMFs) concatenated with two no core fiber (NCF), i.e., SMF-NCF-FMF-NCF-SMF structure is fabricated. The length of the NCF is very short about 1 millimeter acting as exciting/recoupling the light from/into the core of the SMF, while the FMF is with 3 centimeters long supporting four eigenmodes including LP_{01} , LP_{11} , LP_{21} and LP_{02} . High core modes in FMF can be effectively stimulated owing to mismatched mode field distribution and the mainly sensing principle is based on modal interferometer spectrum analysis. Different curvatures induce different strains on the FMF such that affecting the modal excitation, resulting spectrum shifts. One can get the curvature value by tracking the wavelength shifting. Experiments have been done to address the sensing performance, which is about 7.8 nm/m^{-1} within a range of $1.90 \text{ m}^{-1} \sim 3.18 \text{ m}^{-1}$.

Keywords : curvature, four mode fiber, highly sensitive, modal interferometer

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