

Photonic crystal fiber interferometric vector bending sensor

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Abstract.

A compact and highly sensitive interferometric bending sensor (inclinometer) capable of distinguishing the bending or inclination orientation is demonstrated. The device operates in reflection mode and consists of a short segment of photonic crystal fiber (PCF) inserted in conventional single-mode optical fiber (SMF). A microscopic collapsed zone in the PCF-SMF junction allows the excitation and recombination of core modes, hence, to build a mode interferometer. Bending on the device induces asymmetric refractive index changes in the PCF core as well as losses. As a result, the effective indices and intensities of the interfering modes are altered, which makes the interference pattern shift and shrink. The asymmetric index changes in the PCF make our device capable of distinguishing the bending orientation. The sensitivity of our sensor is up to 1225 pm/degree and it can be used to monitor small bending angles ($\pm 2^\circ$). We believe that the attributes of our sensor make it appealing in a number of applications.