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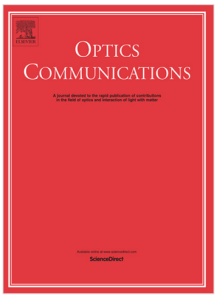

Experimental and theoretical analysis of curvature sensor based on cladding mode resonance with triple cladding quartz specialty fiber

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Experimental and theoretical analysis of curvature sensor based on cladding mode resonance with triple cladding quartz specialty fiber

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Abstract: A curvature sensor based on the triple cladding quartz specialty fiber (TCQSF) is proposed. The TCQSF is spliced between two single mode fibers. The curvature sensor is performed by cladding mode resonance. The TCQSF with the length of 10mm, 35mm, and 50mm is prepared and applied to the curvature measurement experiment. The bending model is created and analyzed by the finite element method theoretically. The experiment results show that the curvature sensitivity of sensor with different length are -1.83001nm/m^{-1}, -1.56231 nm/m^{-1} and -1.0114 nm/m^{-1} in the curvature range of 0~0.94m^{-1}.

Key Words: Cladding mode resonance;fiber-optic sensors; curvature; triple cladding quartz specialty fiber;

1. Introduction

Curvature measurement is an extremely important issue in production and life. It is an important measurement parameter in the fields of industry, aerospace, and aviation, such as bending of bridges and rails, road subsidence, bending of some high-precision instruments and important building structures[1-2]. At present, the method used to measure the curvature is mainly the traditional electrical method, but this method has the disadvantage of low measurement accuracy, which limits its wide application. The optical fiber curvature sensor can solve the shortcomings of the above electrical methods[3,4] effectively, and many studies have been reported at home and abroad. So far a variety of optical fiber curvature sensors have been proposed and studied further, such as fiber grating[5], multi-core optical fiber[6], Michelson structure[7] and other micro-structures[8,9]. For example, Wenjun Zhou hase proposed a temperature-independent curvature sensor formed by splicing a short section of MMF