

## Accepted Manuscript

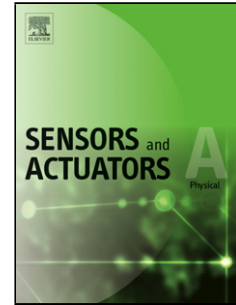
Title: Curvature Sensor Based on Mach–Zehnder Interferometer with Vase-Shaped Tapers

Authors: Yong Zhao, Feng Xia, Mao-qing Chen

PII: S0924-4247(17)30071-7  
DOI: <http://dx.doi.org/10.1016/j.sna.2017.09.005>  
Reference: SNA 10313

To appear in: *Sensors and Actuators A*

Received date: 11-1-2017  
Revised date: 3-7-2017  
Accepted date: 4-9-2017



Please cite this article as: Yong Zhao, Feng Xia, Mao-qing Chen, Curvature Sensor Based on Mach–Zehnder Interferometer with Vase-Shaped Tapers, *Sensors and Actuators: A Physical* <http://dx.doi.org/10.1016/j.sna.2017.09.005>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Curvature Sensor Based on Mach–Zehnder Interferometer with Vase-Shaped Tapers

Yong Zhao<sup>1,2</sup>, Feng-Xia<sup>1,\*</sup>, Mao-qing Chen<sup>1</sup>

<sup>1</sup> College of Information Science and Engineering, Northeastern University, Shenyang, China

<sup>2</sup> State Key Laboratory of Synthetical Automation for Process Industries, Shenyang, China

\* *Corresponding Author Email:* xiafeng@stumail.neu.edu.cn

## Highlight

- A novel Mach–Zehnder Interferometer (MZI) formed by cascading two vase-shaped tapers in a single mode fiber (SMF) is proposed in this work. The vase-shaped taper is fabricated by fusion splicing a fiber sphere with a fiber tip under strong arc discharge.
- The curvature sensing characteristic of the proposed vase-shaped taper-based MZI is experimentally investigated, displaying that the interference spectrum has a blue shift with the increase of applied curvature. The sensor realizes a large range measurement of curvature from 0.9284 m<sup>-1</sup> to 4.0470 m<sup>-1</sup> with sensitivities of -8.41 nm/m<sup>-1</sup> and -16.72 nm/m<sup>-1</sup> in the curvature range of 0.9284 m<sup>-1</sup> to 2.4564 m<sup>-1</sup> and 2.6025 m<sup>-1</sup> to 4.0470 m<sup>-1</sup>, respectively. It also shows a low temperature-curvature cross-sensitivity of -0.0016 m<sup>-1</sup>/°C and -0.00082 m<sup>-1</sup>/°C in the two measurement ranges, which are lower than the corresponding curvature resolutions that are 0.0024 m<sup>-1</sup> and 0.0012 m<sup>-1</sup>.
- The proposed sensor exhibits the advantages of low cost, negligible temperature cross-sensitivity, fine curvature sensitivity and large measurement scale.

## Abstract

A novel Mach–Zehnder Interferometer (MZI) formed by cascading two vase-shaped tapers in a single mode fiber (SMF) is proposed in this work. The vase-shaped taper is fabricated by fusion splicing a fiber sphere with a fiber tip by applying strong arc discharge. The curvature sensing characteristic of the proposed vase-shaped taper-based MZI is experimentally investigated, displaying that the interference spectrum has a blue shift with the increase of applied curvature. The sensor realizes a large range measurement of curvature from 0.9284 m<sup>-1</sup> to 4.0470 m<sup>-1</sup> with sensitivities of -8.41 nm/m<sup>-1</sup> and -16.72 nm/m<sup>-1</sup> in the curvature range of 0.9284 m<sup>-1</sup> to 2.4564 m<sup>-1</sup> and 2.6025 m<sup>-1</sup> to 4.0470 m<sup>-1</sup>, respectively. Its temperature-curvature cross-sensitivities are -0.0021 m<sup>-1</sup>/°C and -0.0011 m<sup>-1</sup>/°C in the two measurement ranges, which are lower than the corresponding curvature resolutions which are 0.0024 m<sup>-1</sup> and 0.0012 m<sup>-1</sup>. The proposed sensor exhibits the advantages of low cost, negligible temperature cross-sensitivity, fine curvature sensitivity and large measurement scale.

**Keywords:** optical curvature sensor; vase-shaped taper; Mach-Zehnder interferometer.

Download English Version:

<https://daneshyari.com/en/article/5008196>

Download Persian Version:

<https://daneshyari.com/article/5008196>

[Daneshyari.com](https://daneshyari.com)