






## Abstract

# A Multispectral Portable Optical Fiber Reflectometer <sup>†</sup>

Wojciech Bogusław Żołąnowski <sup>1</sup>, Anna Pakuła <sup>1,\*</sup>, Paweł Marć <sup>2,\*</sup>, Marek Życzkowski <sup>2,\*</sup>  
and Leszek Roman Jaroszewicz <sup>2</sup>

<sup>1</sup> The Institute of Micromechanics and Photonics, Faculty of Mechatronics, Warsaw University of Technology, 00-661 Warszawa, Poland

<sup>2</sup> Institute of Optoelectronics, Military University of Technology, 00908 Warsaw, Poland

\* Correspondence: anna.pakuła@pw.edu.pl (A.P.); pawel.marc@wat.edu.pl (P.M.); marek.zyczkowski@wat.edu.pl (M.Ż.)

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**Abstract:** Today, multispectral optical sensors are extensively studied in non-contact and remote imaging systems. However, our previous experimental studies have shown that the changes in the reflective properties of chicken eggshells allow for the classification of their origin as either healthy or *Mycoplasma synoviae* (MS)-infected hens. MS is a pathogen affecting poultry that may have a significant economic impacts on poultry breeding. In this work, we present the portable optical fiber reflectometer, which can be used for early MS detection in a flock by the measurement of back-reflected light in a multispectral system. The designed reflectometer consists of control and optical modules. The control module is responsible for the light source and photodetector modulation, the synchronization and the power supply, as well as data recording. The main part of this module is a microcontroller used to ensure flexibility in creating the research sequence during operation. The optical module is based on a fiber bundle with six light outputs and a single detection line. The loose end of the fiber bundle is integrated with an optical head, which shapes the illuminating beam to obtain measurement conditions. The same optical head collects a back-reflected beam that propagates through the detection line to the detector. The application of the optical fiber decreases the weight of the whole system and enables the flexible operation of the optical head, making this system portable. In order to classify the test objects, the collected data were subjected to numerical analysis by means of machine learning.

**Keywords:** optical fiber reflectometer; optical fiber biosensors; machine learning



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