



Cyprus
University of
Technology

Department of Electrical
Engineering and Computer
Engineering and Informatics

Bachelor's Thesis

**Software for Advanced Optical Fiber Speckle Sensing via Polymer Optical
Fiber**

Paun Valentina Katerina

Limassol, May 2024



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**SOFTWARE FOR ADVANCED OPTICAL FIBER SPECKLE
SENSING VIA POLYMER OPTICAL FIBER**

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In loving memory of Phoebe Cecilia Clara Bott.

I dedicate this thesis to the memory of my best friend. Though you are no longer with us, your support during my academic journey continue to inspire me. Your belief in my abilities has given me strength, and I will continue to honor your memory through my accomplishments.

ABSTRACT

Fiber specklegram sensors utilize the unique interference patterns produced by coherent light interacting with the structure of optical fibers to detect changes in environmental conditions. These sensors are highly sensitive to variations in parameters such as refractive index, pressure, temperature, and strain, making them suitable for a wide range of applications. Their capacity to deliver real-time, precise information makes them useful in industries including industrial monitoring, environmental sensing, biological diagnostics, and structural health monitoring.

In this thesis, we present the development and application of advanced software for analyzing fiber optic speckle patterns using polymer optical fibers. Our goal was to enhance the capability of speckle sensing specifically for liquid and pressure sensing applications. The software, developed in Python, integrates various image processing algorithms to detect and analyze changes in the specklegram under different conditions. Key features include real-time image acquisition, video capture, live imaging filters, and a cropping tool. We also conduct experiments to evaluate the software's performance in liquid and pressure sensing, demonstrating its effectiveness and potential for broad applications.