UNIVERSITATEA TEHNICĂ DIN CLUJ-NAPOCA
FACULTY OF ELECTRONICS, TELECOMMUNICATION AND INFORMATION TECHNOLOGY

PHOTONICS APPLICATIONS IN BIOMEDICAL ENGINEERING, ELECTRONICS, TELECOMMUNICATIONS AND NANOTECHNOLOGY

-ABSTRACT-

HABILITATION THESES

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Abstract

This habilitation thesis presents the didactic and scientific activities and the main research results of the author accomplished after defending the PhD thesis entitled "*Methods for Information Extraction and Interpretation în Medical Imaging*", în 2008.

The habilitation thesis is comprised of three chapters. All these chapters will outline the author findings and the results în the field of Electronics, Telecommunication and Information Technology Engineering with Applications in Nanotechnology.

Chapter 1 - Academic and professional achievements. This chapter presents the synthesis of the author's activities until nowadays (2018) by describing în subchapter 1.1 the didactic evolution, subchapter 1.2 - collaborations with the students and respectively în subchapter 1.3, synthesis of the research activities on the three main subdirections: electrical systems and medical engineering (as early stage researcher, during PhD activities) and photonics, optoelectronics and optics (after doctoral defending).

Chapter 2 - Applications of photonics. în this chapter the research results related to photonics, în the postdoctoral period, are mainly discussed as a natural continuation of the activities în this field, starting with doctoral period.

The chapter is organized în 4 subchapters:

Subchapter 2.1 Optical guides, optical fibers and sensors. It presents the development stages of three main research directions related to:

- Sensor/biosensor Implementation based on the **plasmonic phenomenon**. The practical results obtained were mainly funded by the UEFISCDI-PED67 (2016-2018) research projects and will continue with ERANET-SALIVAGES (2018-2021), also supported by scholarship as invited professor and researcher, funded by UNINA2, Italy (2013), a post-doctoral internship at UMONS, Belgium and Horizon2020-COST projects where I actively participate as an expert researcher on Optoelectronics and Photonics fields
- optimized design of **optical amplifier waveguides**, such as the microring optimized components with amplification properties, codopped with rare earths Yt^{3+}-Er^{3+}, and straight waveguides based on $LiNiO_3$, with amplification function due to the Er^{3+} doped rare-eartyh components. The practical results was financial supported during the project "Femtosecond-laser Assisted Self-Organization Processes for Photonics: Design of Photonic Devices and Experimental Characterization ", coordinated by the University of Zaragoza, Spain, where I received a postdoctoral research internship.
- **optical sensors implemented with special fibers** such as LMA (large mode area), PCF (photonic crystal fibers), fluorescent and SEF (surface emission optical fiber). The practical results obtained are mainly funded with the ASTR-CA1/2016 project and HydroSens and DAMFU projects.

Subchapter 2.2 **Image Processing**. The activities of the doctoral dissertation are briefly presented: the automatic diagnosis system for citologic slides analysis during the Pap net procedure for CIN classification, algorithms for segmentation and statistică classification with original contributions developed by the author and the archiving of results using a virtual cytopathology laboratory implementation, with remote access of the specialists affiliated to that laboratory. The results obtained were mainly funded by the project

"Research on the Development of Computerized Techniques for Cytological Screening and Assistance of Histopathological Diagnosis", CNCSIS 885, 2002-2004.

Sub-chapter 2.3 Renewable energies, reffering to the procedure to produce the optimal organic solar cells. The practical results are supported by the POC-ORGLIGHT2018 project.

Chapter 3 - Future Directions for Professional Development and Research Activities. It presents the didactic and research objectives that emerge în the next stage. For the research direction are proposed possible doctoral themes, with the possibility of co-tutelle coordination, due to the multidisciplinary character of the research, on the fields financed by the ongoing projects: SALIVAGES started în 2018 on biosensors, Integrated Microwave Photonics started în 2018 în the field of automotive and ORGLIGHT 2018 respectively, în the field of renewable energies.