Review of the doctoral thesis

Thesis Title:	*Methods of Effective Signal Coupling into the Photonic Crystal Fibers*
Author:	*Ing. Dmytro Suslov*
Supervisor:	*Ing. Matěj Komanec, Ph.D.*
Co-supervisor:	*prof. Ing. Stanislav Zvánovec, Ph.D.*
Faculty:	*Faculty of Electrical Engineering, Czech Technical University in Prague*
Study Programme:	*2601V010 Radioelectronics*
Reviewer:	*doc. Ing. Lucie Hudcová, Ph.D., Dept. of Radio Electronics, Faculty of Electrical Engineering and Communications, Brno University of Technology*

1. **Topicality of the selected theme**

   The theme of the dissertation is topical concerning the development in the field of modern optical fibers. The work is thematically focused on the novel coupling methods, which lead to advanced interconnection techniques.

   Without a doubt, this is a very current and promising topic.

2. **The fulfillment of the objectives of the dissertation**

   The objectives of the submitted dissertation are clearly defined in Chapter *3. Objective of the thesis*. These goals were divided into the following 5 points:

   - Accurate PCF model including imperfections in the real post-draw PCF structure.
   - Design and optimization of mode-field adaptation for SMF-to-HCF (HCF-to-SMF).
   - A method of Fresnel loss suppression that occurs at the SMF-to-HCF interface.
   - Proposal and experimental verification of bidirectional SMF-to-HCF (HCF-to-SMF) interconnection in a complete SMF-HCF-SMF fiber component.
   - A practical evaluation of the proposed and developed interconnection with state-of-the-art hollow-core fibers, showing its high potential in cutting-edge applications.

   The individual goals of the dissertation logically follow each other and complement each other. To achieve the defined goals, the author has published as the main author and co-author 5 journal publications where the particular tasks are solved.

   The goals of the submitted dissertation are fulfilled, particular challenges are solved within the core of the dissertation published in chapter *4. Accomplished results*.

3. Selected methods for elaboration of dissertation work

The submitted dissertation is written in English, it contains 5 chapters. After an introduction to the problematics of Photonic Crystal Fibers in Chapter *1. Introduction* followed by Chapter *2. State of the art*, which on 17 pages presents the theoretical background of the coupling theory, coupling methods, and interconnection techniques leading to the practical solution of the PCF-SMF coupling and interconnection.

The core of the dissertation, which is presented in Chapter *4. Accomplished results*, consists of 5 publications published in selected impact factor journals. Each publication is presented in a separate sub-chapter, it is accompanied by a short description with an indication of the objectives of the dissertation.

Individual publications were published between 2019 and 2021, which also indicates the topicality of the dissertation theme. In two key publications, the author of the submitted dissertation is the main author, in three cases he is a co-author of publications.

4. Dissertation results

The submitted dissertation has several important outputs and results. These include, for example:

- A well-arranged description of PCFs in chapter 2. This part of the dissertation work could be used as a high-quality study material.
- An overview of the coupling methods and interconnection techniques in chapter 2.
- Effective modeling technique for real photonic crystal fibers (PCFs) characterization.
- Coupling method leading to a permanent SMF-to-PBGF interconnection based on a fiber-array technology.
- Low interconnection loss of 0.15 dB between a nested antiresonant hollow-core fiber and SMF.
- Fabrication of 5 m and 23 m long HCF-FPs with finesse over 140 and 120.
- The research and the analysis of the thermal stability of different configurations of optical fiber-based delay lines in microwave photonics.

The achieved outputs, the measured data of the work, and the results published in journals with high professional significance contributed to the development in the field of optical communications or fiber sensors.

5. Publication outputs of the Ph.D. student

The publishing activity of the Ph.D. student is wide. In addition to the mentioned 5 articles published in journals with an impact factor, 3 of them are Q1, the rest 2 are Q2. He is the author of 3 conference articles that are directly related to the topic of the dissertation.

The doctoral student is also a co-author of 3 IF articles and 6 conference articles indexed on the Web of Knowledge, which are not directly related to the dissertation, but also deal with optical fibers.

The dissertation undoubtedly meets the conditions for independent creative scientific work.

6. Reviewer's questions

In one of your key papers (*Low-Loss and Low-Back-Reflection Hollow-Core to Standard Fiber Interconnection*) you mention: "The resulting interconnection provides for a low insertion loss due to the fact that the HCF microstructure is not deformed during the gluing (low temperature) process …". What would happen if the interconnected fiber heated rapidly during its operation due to external conditions? Would the attenuation of the interconnection change significantly? Is there any passive or active element that would prevent (or protect from) unwanted external heating of the interconnection?

In your paper *Optical fiber delay lines in microwave photonics: sensitivity to temperature and means to reduce it* you show an overview Table 1, where you present the values of dispersion for individual types of fibers depending on the temperature. Do you assume that the given values of dispersion would change if these fibers were operated in places with significantly different (lower or higher) atmospheric pressure?

7. Final evaluation

The assessed dissertation is high quality work, including work with references. Minor shortcomings in the text of the thesis do not affect the qualitative aspect of the submitted dissertation work. Everything important is explained in the text, or a suitable reference to the source of information is used.

The core of the submitted dissertation is in 5 publications published in relevant impact factor journals. All of these publications are very beneficial for the further development of the area of optical fibers.

Based on the above facts, I definitely **recommend** the submitted dissertation for defense.

In Brno 7/6/2021 doc. Ing. Lucie Hudcová, Ph.D.