Master/engineer degree intership position

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Point-by-point femtosecond laser inscription of fiber Bragg gratings in optical fibers

The discovery of optical fibers in the 1960s led to a wide range of applications, from telecommunications to fiber based sensors or fiber lasers to cite a few. Methods for optimizing and functionalizing optical fibers have led to the emergence of new fiber compositions over the past decades, as well as microstructured fibers that greatly diversify the potential applications. This is the case, for example, with fiber Bragg gratings (FBGs). This type of fiber components has been nowadays widely used for its applications in the fields of lasers and sensors [1].

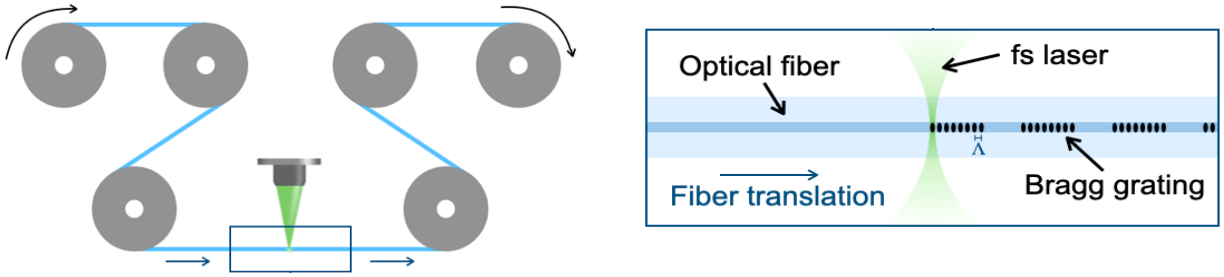

Figure : Schematic view of the reel-to-reel setup and of the inscription of fiber Bragg gratings

A Bragg grating is a structure composed of periodic changes of the refractive index. Depending on the grating parameters (mainly the period), guided light will be selectively reflected at the Bragg wavelength and transmitted at any other wavelength. When the optical fiber is exposed to changes in temperature, stress, or pressure, the Bragg wavelength is shifted making the fiber very sensitive to its surrounding environment and thus a highly reliable optical sensor. Among the existing FBGs manufacturing methods, the point-by-point approach involves the use of a femtosecond laser. When focused in the core of the fiber, such a laser induces permanent modifications of the refractive index locally at the microscale [2]. By translating the optical fiber, periodic structural changes with easily adjustable periods, and thus controllable FBGs properties, can be inscribed [3].

During this internship, the objectives are to design, fabricate and characterize FBGs in a standard and specialty optical fiber (e.g. with nanoparticles-doped cores) using the above-mentioned point-by-point method. Using a spatial light modulator, the writing laser beam will be shaped to overcome optical aberrations [4]. The candidate will also have the opportunity to set up a new reel-to-reel arrangement equipped with a feedback imaging system to enable controlled femtosecond laser structuring in optical fibers over arbitrarily long distances.

Required knowledges
Basics in photonics, optical fibers and Python and a strong interest in optical instrumentation

References
[1] S. P. Kok, et al., *IEEE Sensors Journal*, vol. 24, no. 19, 2024.
[2] R. Gattass, E. Mazur, *Nature Photon*, vol. 2, no. 2008.
[3] G. D. Marshall et al., *Optics Express*, vol. 18, no. 19, 2010.
[4] P. S. Salter et al., *Optics Letters*, vol. 43, no. 24, 2018.