Light Science & Applications

Optical resonances for point-to-point sensing based on forward stimulated Brillouin Scattering

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Pump and probe techniques to investigate Forward Stimulated Brillouin Scattering have stablished themselves as the most common approach to interrogate acoustic resonances generated in fiber-optic based micro resonators. In recent years, we have explored the use of all-optical resonances of the vibrating platform as the probe optical signal, which has paved the way for interesting applications and measurements. The interplay between transverse acoustic modes (TARs) generated in the cylindrical optical fibers, and fiber Bragg gratings or long period gratings and whispering gallery modes has helped us to measure parameters such us Poisson's ratio with unprecedented accuracy, its temperature dependence and its nonlinearity with strain. Also, the use of high Q resonances as Whispering Gallery Modes (WGMs) has allowed us to achieve axial resolutions for TARs detection of less than one millimeter, leading to the narrowest reported TARs linewidths to our knowledge. The high Q value of such resonances also allowed us to study the influence of such parameter on the probing technique.

In parallel, the use of all-fiber ring resonators has been used to introduce the concept of all-optical mass microbalance based on FSBS. With an estimated detection limit of 1 picogram for a few cm of sensing platform, this technique opens up the possibility of biosensing applications.

Finally, we are currently studying novel configurations for the excitation of radial acoustic resonances in microspheres. We have obtained acoustic frequency combs with more than 50 lines by using WGMs as the probe signal, and have developed a technique for a fine tuning of these lines up to ~70 times the resonances' linewidth.

Short Bio:

Martina Delgado-Pinar received his PhD degree in Physics, specialty Photonics, from Universitat de València (Spain), in 2008. After a postdoctoral research stay in the Centre for Photonics and Photonics Materials (University of Bath, UK), she rejoined the Laboratory of Fiber Optics, where she is currently assistant lecturer of Applied Physics (Electromagnetism). From the beginning of her academic career, she has been investigating on the interplay between acoustic and optical waves and resonances, and its application on fiber devices such as sensors, biosensors or lasers. In parallel, she has worked on nonlinear processes and other fundamental phenomena on conventional, tapered and photonic crystal optical fibers.