

Brillouin Optical Time-Domain Distributed Analysis of Cladding Modes in a Coated Fiber

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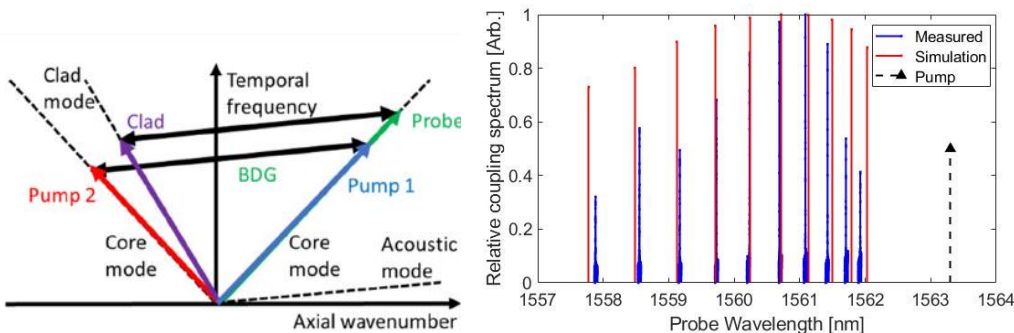
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Motivation and Objectives

- Cladding modes fiber optic sensors widely used in fiber-optic chemical sensing.
- Coupling of light from the core mode to a cladding mode relies on fiber gratings [1,2].
- Bragg gratings inscribe permanent perturbations in the fiber, at specific pre-set locations.
- Cladding modes sensors are limited to point measurements only.
- **Objective: Spatially distributed analysis of cladding modes with no permanent gratings, on standard unmodified coated fiber.**

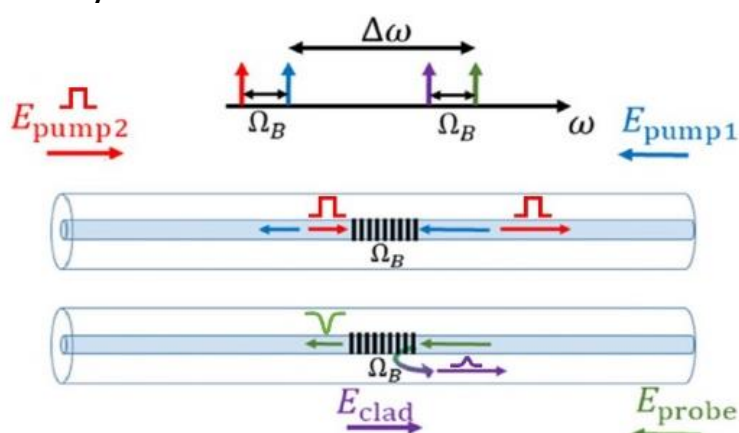
BDG coupling to cladding modes [3]

- Alternative for the permanent inscription of gratings is Brillouin dynamic gratings (BDGs).
- Two counter-propagating pump waves generate acoustic wave in the core of the fiber through backward SBS.
- Probe wave is reflected by BDG to counter-propagating cladding mode.



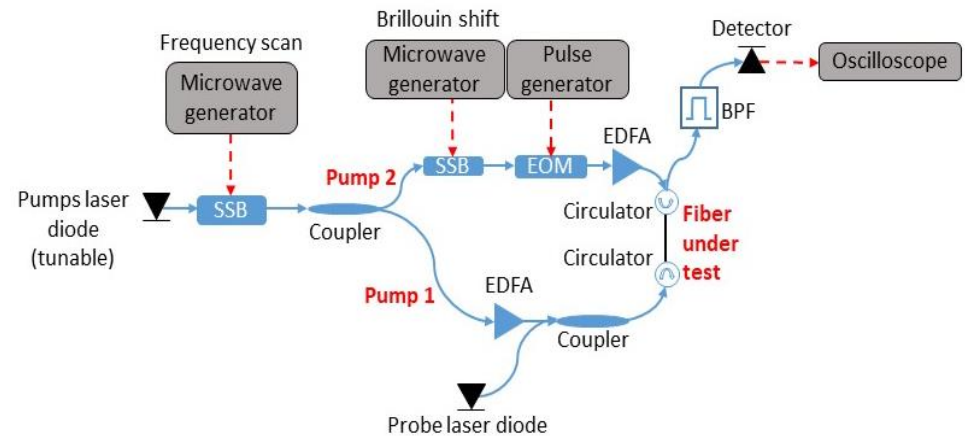
Distributed analysis (B-OTDA) [4]

- Brillouin optical time-domain analysis (B-OTDA) of the cladding modes of coated fibers.
- BDGs are formed using one continuous pump wave and another that is modulated by short pulses.
- Continuous probe wave is coupled to a cladding mode by the BDG.



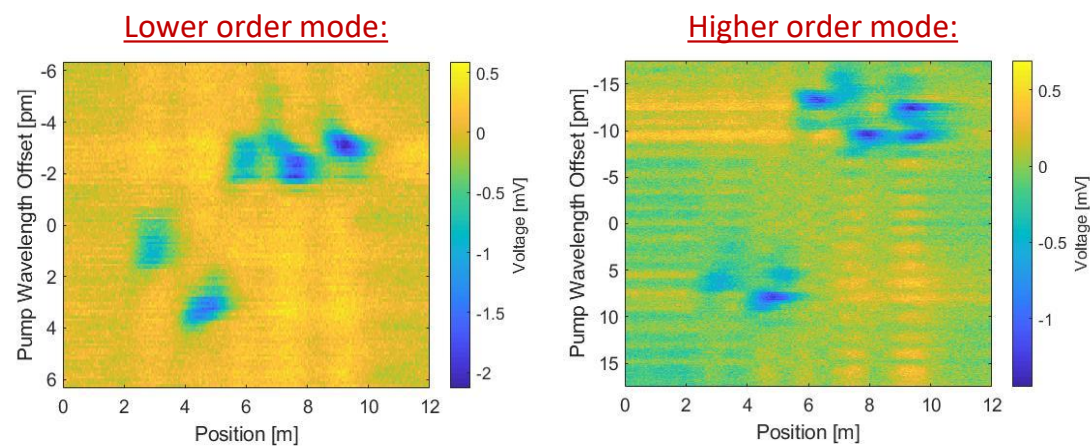
Experimental setup

- Five 1 meter-long segments of SMF28, coated with a fluoroacrylate polymer, 5.5 μm thickness.
- BOTDA of coupling to a cladding modes of coated, unmodified fiber, using BDG.

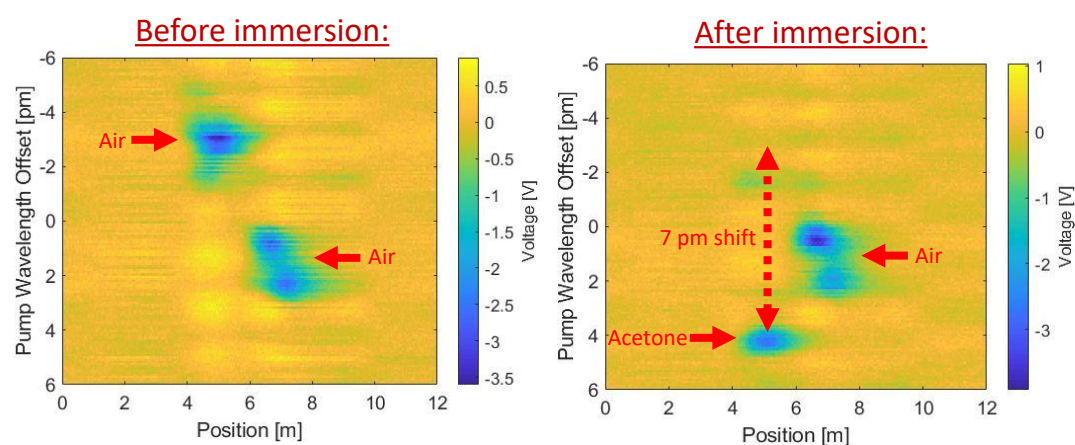


Results

- Coupling to 2 orders of cladding modes in five sections of coated fiber.



- Coupling to the same cladding mode order, before and after immersion of first fiber section in acetone.



[1] V. Bhatia *et al.*, Opt. Lett. 21, 692–694 (1996).
 [2] T. Erdogan *et al.*, J. Opt. Soc. Am. A 14, 1760–1773 (1997).
 [3] G. Bashan *et al.*, Optica 7, 85-92 (2020).
 [4] E. Zehavi *et al.*, Optica (Accepted, 2022).