

Abstract

Exploiting Brillouin Sensors for Refractive Index Measurements [†]

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In this paper, we investigate the capability of a Brillouin Optical Time-Domain Analysis (BOTDA) sensor to act, for specific fiber sections, as a refractometer. In the BOTDA configuration, a pump pulse is launched from one end of the sensing fiber, while a frequency-detuned probe wave is injected from the opposite end. Measuring the output probe intensity as a function of time and for several pump/probe frequency shifts, the strain and/or temperature changes can be recovered at each position. The same apparatus can be used for refractive index measurements in selected points, provided that some means is found to convert the refractive index changes in optical transmission changes. In fact, the localized optical loss can be easily recovered from the acquired data, as each attenuation point along the fiber will induce a step-like change in the detected signal. The minimum distance between consecutive refractive index sensing points is dictated by the spatial resolution of the BOTDA sensor (and therefore by the duration of the pump pulse), while the maximum number of sensing locations will be limited by the ratio between the optical budget (i.e., the maximum optical loss that can be tolerated by the interrogation system) and the (maximum) optical loss in each sensing location.



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