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Poster

Simplified configuration of fiber-optic Brillouin observation using tunable reflectivity mirror

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Abstract: Strain and temperature sensors based on Brillouin scattering in optical fibers have garnered interest for their ability to measure strain and temperature distributions, making them highly applicable to structural health monitoring. Here we focus on a method that observes the spectrum of spontaneous Brillouin scattering throughout the entire length of the fiber under test (FUT) by injecting light into one end of the FUT. Generally, the precise observation of the Brillouin gain spectrum (BGS) using the frequency resolution of an optical spectrum analyzer is challenging, thus requiring the use of self-heterodyne detection. This method involves interfering the scattered light from the FUT with the reference light and converting the beat frequency component into an electrical signal, which is then observed using an electrical spectrum analyzer. Recently, efforts have been made to simplify the Brillouin observation system and reduce costs. One approach involves eliminating the independent reference light path. Previously proposed methods utilized the Fresnel-reflected light at the air boundary of the FUT open end and the boundary between the second port of an optical circulator and the FUT as reference light sources. However, controlling the power of the Fresnel-reflected light, which remained constant in these methods, made it difficult to maximize the signal-to-noise ratio (SNR) of the BGS. Therefore, in this study, we attempted to maximize the SNR of the observed BGS by eliminating the reference light path and instead controlling the reflectivity using a tunable reflectivity mirror placed at the open end of the FUT.

Keywords: Optical reflectometry; Brillouin scattering

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