Distributed Pound-Drever-Hall Technique for Fast Brillouin Optical Time Domain Analysis

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The Pound-Drever-Hall (PDH) technique is a powerful method for laser frequency stabilization, and a PDH loop can also act as a single-channel sensor with high resolution and fast response speed. In this work, we expand the PDH technique into a time-domain distributed form, accomplishing a fast Brillouin optical time domain analysis (BOTDA) scheme which measures the distribution of Brillouin frequency shifts along the optical fiber without frequency scanning. Approaches of phase modulated probe light, synchronous demodulation for PDH error, arbitrarily accessing in single interrogation, and distributed form feedback control are employed in the system. The scheme achieves fast measurement speed and large dynamic range at the same time, as well as good response linearity and high tolerance to optical power fluctuation. In the demonstration experiment, sensing resolution of 0.4 MHz and measurement range of 300 MHz are realized, under the condition of 25 km single-mode communication fiber, 5 m spatial resolution and 0.24 s measurement time (400 times of averaging).

Short Bio:

Zuyuan He received BS and MS degrees in Electronic Engineering from Shanghai Jiao Tong University, China, in 1984 and 1987, respectively, and PhD degree in Photonics from the University of Tokyo, Japan, in 1999.

He joined Nanjing University of Science and Technology, China as a Research Associate in 1987, and became a Lecturer in 1990. In 1999, he became a Research Associate of the University of Tokyo. In 2001, he joined CIENA Corporation, USA, as a Lead Engineer heading the optical testing and optical process development group. He returned to the University of

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