An Efficient Strain/Temperature Identification Method Of Botda System Based On Bayesian Inference

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Brillouin optical time domain analysis (BOTDA) is an efficient distributed structural strain/temperature measurement technique that uses a probe laser to identify fiber Brillouin frequency (BF), which is directly related to structural strain and temperature. However, the traditional BF identification method is to gradually change the probe laser scanning frequency, which is time-consuming. In order to improve the sensing efficiency of BOTDA, a two-stage strain/temperature identification method of BOTDA system based on Bayesian inference is proposed. In the first stage, the probe laser scans only a few frequency points spread over the whole spectrum with large intervals to preliminary locate the BF. In the second stage, the frequency points near BF located in the first stage is focused by the probe laser to determine the exact value of BF. The ability to quantify the confidence of uncertain parameters of Bayesian inference is utilized to determine the second stage scanning strategy and to ensure the adequacy of frequency scanning data, so that the proposed two-stage identification method can significantly reduce the time consumption of BOTDA's structural strain/temperature sensing without relaxing identification accuracy. Finally, experimental data of BOTDA strain sensing are used to verify the efficiency of the proposed two-stage identification method based on Bayesian inference.