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High-Sensitivity Sensor Fabricated on the Basis of Single-Mode Fiber Loop Using Frequency-Sweeping-Generated Ringing Effect

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Currently, people are looking for a simple and effective method to detect minor changes in fluid environments. In this article, we propose a simple method to detect such changes using the ringing phenomenon generated by frequency sweeping in a single-mode optical fiber resonator. The method is based on the fact that the insertion loss of the optical fiber resonator is determined by environmental changes alone, which leads to the changes in the cavity ringdown time of the fiber resonator. It has several superior advantages over the frequency-domain method, one of which is that the minimal detectable optical loss is on the order of 10^{-6}. In this article, we also show that the sensing system is insensitive to temperature drifting, which overcomes the main defect of fiber loop resonators, that is, they are extremely sensitive to temperature changes. The structure of the sensor is compact and stable owing to the characteristic of optical fiber resonators, and it is easy to use in practical application because the structure is not delicate and is easy to construct.

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