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Fiber-Loop Ring-Down Magnetic Field and Temperature Sensing System Based on the Principle of Time-Division Multiplexing

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Abstract. A combined magnetic field and temperature sensing system based on the principle of time-division multiplexing was developed. A fiber-loop ring-down technique was introduced to enhance the stability and sensitivity of the system. Magnetic sol-gel was coated onto a single-mode fiber with its cladding partly etched to form the magnetic field sensor head. A temperature-deformation converter was employed in the temperature sensing unit. A delay fiber was used to adjust the decaying pulses of the two sensing units. The influence of temperature on the magnetic field sensor head was experimentally investigated. The magnetic field strength exhibited a well-defined linear relationship with respect to the inverse of the ring-down time over a range of 25–70 mT with a sensitivity of 12.7 ns/mT, and the temperature showed a well-defined linear relationship between 20.3 °C and 79.7 °C with a sensitivity of 3.53 ns/°C when the magnetic field intensity was 25 mT.

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