## Attenuation auto-correction method in Raman distributed temperature measurement system

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**Abstract** A novel method to auto-correct and compensate the attenuation in Raman distributed temperature sensors is proposed. This method utilizes a fiber in loop configuration combined with a reference temperature in the front section to cancel out the impact of attenuation generated by different wavelengths, local external perturbations and environment changes. The conception is successfully verified by theory and experiments. Rapid measurements are shown, with 1,250 m fiber in loop configuration, allowing for a 2.5 °C improved temperature accuracy compared to the conventional method.

**Keywords** Attenuation auto-correction  $\cdot$  Loop configuration  $\cdot$  Distributed temperature sensing

## **1** Introduction

Distributed temperature sensors (DTS) have been studied for many years, and have been employed in large variety of application areas (such as the monitoring of oil pipelines, high-voltage cables and leakage-detection of dams) thanks to their excellent sensing capabilities (Culshaw and Kersey 2008; Park et al. 2006; Zhang and Feng 2008).

For the DTS, the Raman DTS (RDTS) have been most widely used and investigated. In the most common sensing schemes, the temperature is calculated by the backscattered Raman anti-Stokes (AS) and Stokes (S) (or AS and Rayleigh) components in a single-ended configuration. The RDTS instrument launches a short laser pulse into the sensing fiber and

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