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Upconversion Brillouin optical-time domain reflectometry

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A direct-detection Brillouin optical time-domain reflectometry (BOTDR) using a photon-counting up-conversion detector (UCD) and an all-fiber structure Fabry–Perot scanning interferometer (FFP-SI) is demonstrated with shot-noise limited performance. In order to detect the weak spontaneous Brillouin backscatter signal efficiently, an ultra-low noise equivalent power of the photon-counting UPD is adopted, which up-converts the backscattering signal at 1548.1 nm to 863 nm, and then detected by a Si-APD. The final system efficiency of the UPD is 15% with a noise of 40 counts per second. By using high spectral resolution of the FFP-SI, the Brillouin spectra along a polarization maintain fiber (PMF) is analyzed in the optical frequency domain directly. In comparison with heterodyne BOTDR, direct-detection BOTDR has better EM compatibility and faster speed in data processing. In experiments, with peak input power of 20 dBm, temperature profile along a 9 km PMF is retrieved according to the Brillouin shift, with spatial/temporal resolution of 2 m/15 s. The precision is 0.7°C at the leading end and 1.2°C at the trailing end.

Biography

Mingjia Shangguan has received his BS degree from Jilin University of Architecture in 2012. He is pursuing his PhD in Hefei National Laboratory for Physical Sciences at the Microscale at University of Science and Technology of China. His current research interests include Upconversion Technique and its application in Optical Fiber Sensors.

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