Phase-sensitive correlation optical time-domain reflectometer using quantum phase noise of laser light.

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Abstract.

We propose and experimentally demonstrate a simple approach to realize a phase-sensitive correlation optical time-domain reflectometer (OTDR) suitable for detection and localization of dynamic perturbations along a single-mode optical fiber. It is based on the quantum phase fluctuations of a coherent light emitted by a telecom DFB diode laser. Truly random probe signals are generated by an interferometer with the optical path difference exceeding the coherence length of the laser light. Speckle-like OTDR traces were obtained by calculating cross-correlation functions between the probe light and the light intensity signals returned back from the sensing fiber. Perturbations are detected and localized by monitoring time variations of correlation amplitude along the fiber length. Results of proof-of-concept experimental testing are presented using an array of ultra-low-reflectivity fiber Bragg gratings as weak reflectors.