Abstract

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Amendment performance of an apodized tilted fiber Bragg grating for a quasi-distributed-based sensor

In this work, the characteristics of reflectivity spectra produced inside a reflective-tilted fiber Bragg grating (R-TFBG) are investigated, seeking a remarkable performance that could be able to upgrade the sensitivity range for temperature-strain sensors of quasi-distribution type. We introduce an optimized performance through a comparative investigation among different evaluation parameters, such as core radius, tilt angle, and the elite Selection of apodization profiles, in addition to the traditional parameters, such as grating length, L, and index modulation amplitude, ?n. Regarding the tilt angle, its increase affects the full width at half-maximum (FWHM) affirmatively, while having a negative impact on the maximum reflectivity. By controlling L and ?n, a compromised solution is achieved to retrieve the maximum reflectivity to be around 1.0. Regarding the sidelobes, the Kaiser profile is the best candidate that minimized the main sidelobe level (MSL) and raised the sidelobe suppression ratio (SLSR) at any tilt angle, while tanh apodization is the best choice from the perspective of raising the ramp down sidelobes asymptotic decay. The contrasts in the optimization process are examined through investigating the R-TFBG quasi-distributed sensors to be applied to a temperature-strain sensing system. The objective is to evaluate an assessment for the performance of a sensor system that extends the range and efficiency of temperature-strain ranges. Based on our analysis, the sensitivity range is upgraded for a temperature change to reach 179°C and for strain to be 3000 ?? at a tilt angle of 10° with a FWHMof 0.063 nm, attenuation of ?154 dB for an MSL of 75.5%, and an SLSR of ?60 dB?nm.