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Influence of the length of a uniform fiber Bragg grating on the accuracy of measuring an impulsive strain

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Keywords

optical fiber Bragg grating sensor, impulsive strain, converting error

Abstract

The influence of the length of a uniform, unapodized and apodized fiber Bragg grating on the accuracy of converting an impulsive strain is discussed. Using the transfer matrix description of the grating, derived from the coupled mode theory, the reflectivity spectrum changes of the grating are calculated, which are caused by the strain pulses propagating along it. On the basis of the introduced effective central frequency of the grating, the rise-time error (RTE) and the amplitude error of the frequency change (AFCE) were calculated as a function of the ratio of the strain pulse leading front width to the grating length. These errors were calculated for different waveforms of the strain pulses. Charts presenting results of the calculations allow to select the proper length of the uniform fiber grating, when the converting error is established, and the waveform of the pulse is identified.