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Measurement of Arbitrary Strain Profiles of Fiber Bragg Gratings in Fabry-Perot-like Transmission Spectra Using a Real-Coded Genetic Algorithm

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In this paper, we propose a method of measuring arbitrary strain distribution using real-coded genetic algorithm optimization processes to analyze the reflection-intensity spectra of Fabry-Perot-like fiber Bragg gratings (FBGs). The reflected spectra produce Fabry-Perot-like effects, and the grating is subjected to the strain field. Because of the Fabry-Perot-like effect, strain profiles produce different reflection-intensity spectra. Thus, the arbitrary strain distributions along the embedded length of FBGs can be immediately obtained from the Fabry-Perot-like reflective spectra. The correctness of the proposed methods was demonstrated numerically by reconstructing the strain distributive profile in the FBGs, to which several different nonuniform strains were applied (linearly negative gradient, linearly positive gradient, and discontinuity strains). The proposed methods were demonstrated to enable accurate strain reconstruction with no restrictions on the applied strain profile.

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