Strain Sensor based on Four-Wave Mixing using Raman Fiber Bragg Grating Laser Sensor with Cooperative Rayleigh Scattering

Hugo F. Martins[1,2], Manuel B. Marques[1,2], Orlando Frazão[2]

[1] Faculdade de Ciências da Universidade do Porto, R. do Campo Alegre, 687, 4169-007 Porto, Portugal.
[2] INESC Porto, Rua do Campo Alegre, 687, 4169-007 Porto, Portugal.

Fiber Bragg grating (FBG) sensors can be used as sensing head for the measurement of strain, temperature or others physical parameters [1]. The variation of these parameters induces changes of the central Bragg wavelength, which can also be converted in optical power variation through a linear filter [1]. The Rayleigh scattering growth can be a problem for specific applications namely in optical communications but can be used as a distributed mirror to enhance the generation of Brillouin Stokes combs [2], multiwavelength generation [3] and distributed lasers [4]. The Four-Wave Mixing (FWM) for wavelength conversion has advantages that include large spectral and dynamic range as well as providing strict bit rate and modulation format transparency. In optical sensing, this effect is underexplored. Only in 2007 was demonstrated a fiber ring laser sensor for strain-temperature discrimination [5]. In this work, the authors present two possibilities for an interrogation system based on FWM effect obtained by two Raman fiber Bragg grating laser sensors with cooperative Rayleigh scattering. Due to the transfer function of the FWM efficiency, it is possible to obtain a temperature-independent strain sensor when the power of the converted signal is used. The second possibility is to use the difference between the signal sensor wavelength and the converted signal wavelength to obtain a temperature-independent strain sensor [6].

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