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Zhi Zhou, Peng Li, Yuan Li, Peng Zhao, Hai Xiao, Jinping Ou

Novel Coaxial Cable Sensors for Large Strain Measurement in SHM

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Civil Structural Health Monitoring Workshop. Berlin. Germany. 2012. Report. Monitoring of structure integrity is technically challenging because these engineered structures are inherently large in dimension and geometrically complex. The general requirements on the monitoring technology include high resolution, large dynamic range, low cost, excellent reliability, and remote operation at a long working distance. However, current sensing technologies still have difficulty to meet these requirements. Therefore, there is a continuing need for developing new sensor technologies to address the challenges and ensure the safe operation of the nation's critical infrastructures. Inspired by the concept of one-dimensional photonic crystal and fiber Bragg grating signal mechanism, a novel coaxial cable Bragg grating (CCBG) is proposed. This paper firstly investigated the working mechanism and the Bragg condition of CCBG by transmission line theory and coupled mode theory .Then, through advanced modeling and simulation the large strain sensor was designed and fabrication for SHM. And a maximum range around 70000με; (7%) and good linearity were demonstrated by the sensing experiments. Finally, a kind of high-precision demodulation techniques based on a positive feedback analogue oscillator system was realized, which can obtain high signal to noise ratio, narrow bandwidth signal, making the resolution of CCBG of 11.4 με;. The results showed that: CCBG has the characteristics of a wide range, high-resolution to meet the needs of the harsh environment for SHM.

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Ключевые слова:

Содержание