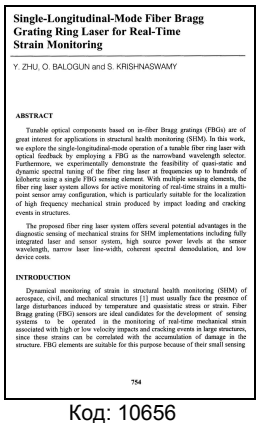

Single-Longitudinal-Mode Fiber Bragg Grating Ring Laser for Real-Time Strain Monitoring

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ABSTRACT

Tunable optical components based on in-fiber Bragg gratings (FBGs) are of great interest for applications in structural health monitoring (SHM). In this work, we explore the single-longitudinal-mode operation of a tunable fiber ring laser with optical feedback by employing a FBG as the narrowband wavelength selector. Furthermore, we experimentally demonstrate the feasibility of quasi-static and dynamic spectral tuning of the fiber ring laser at frequencies up to hundreds of kilohertz using a single FBG sensing element. With multiple sensing elements, the fiber ring laser system allows for active monitoring of real-time strains in a multi-point sensor array configuration, which is particularly suitable for the localization of high frequency mechanical strain produced by impact loading and cracking events in structures.

The proposed fiber ring laser system offers several potential advantages in the diagnostic sensing of mechanical strains for SHM implementations including fully integrated laser and sensor system, high source power levels at the sensor wavelength, narrow laser line-width, coherent spectral demodulation, and low device costs.

INTRODUCTION

Dynamical monitoring of strain in structural health monitoring (SHM) of aerospace, civil, and mechanical structures [1] must usually face the presence of large disturbances induced by temperature and quasistatic stress or strain. Fiber Bragg grating (FBG) sensors are ideal candidates for the development of sensing systems to be operated in the monitoring of real-time mechanical strain associated with high or low velocity impacts and cracking events in large structures, since these strains can be correlated with the accumulation of damage in the structure. FBG elements are suitable for this purpose because of their small sensing

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Ключевые слова:

Содержание.