

## FBG based Strain and Vibration Sensor

Real-time monitoring can be a critical asset, especially for transportation and infrastructure facilities. For condition monitoring of railways, bridges and dams etc. fault is found manually by naked eyes right now. Real-time condition monitoring with embedded optical strain and vibration sensor can certainly avoid running structure with fault components.

### ➤ Characteristics of FBG as a strain sensor :

- Robust mechanical housing for harsh environment.
- Immunity to EMI/RF interferences.

### ➤ Characteristics of FBG as a vibration sensor :

- Robust design for harsh environment.
- Immunity to EMI/RF interferences.
- Shock absorbance upto 2500 g acceleration.

### ➤ Operating Principle of FBG based strain and vibration sensor :

A fiber Bragg grating (FBG) is a type of distributed reflector that reflects a particular wavelength of light and transmits all other. This is done by adding a periodic variation to the refractive index of the fiber core. When strain around grating changes, shift in reflected wavelength is observed and given by,

$$\Delta\lambda_{\text{Bragg}} = [(1 - p_e) \cdot \epsilon + (\alpha + \zeta) \cdot \Delta T] \lambda_{\text{Bragg}}$$

where  $p_e$  is the strain-optic coefficient,  $\epsilon$  is the strain induced,  $\alpha$  is the thermal expansion coefficient,  $\zeta$  is the thermo-optic coefficient and  $\Delta T$  is change in temperature. For determination of vibration of system, dynamic strain is considered for calculation.



**Fig.** Offered FBG MSS-01 strain sensor



**Fig.** Offered FBG VbS-01 vibration sensor

➤ **Applications of FBG based temperature sensor :**

- Wheel impact load detection on Railway tracks.
- Axle counting of Bogies.
- Structural condition monitoring of Bridges and Dams.
- Health monitoring of Aircrafts.
- Vibration monitoring of structures.