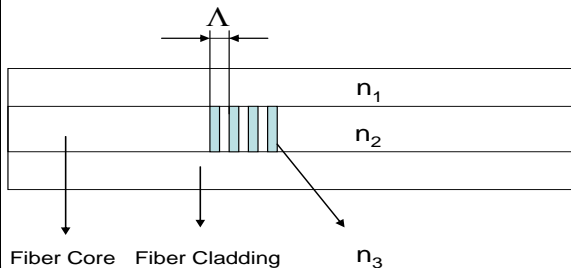


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FIBER BRAGG GRATING

The fiber bragg grating is a short section of optical fiber in which the core refractive index is modulated periodically.

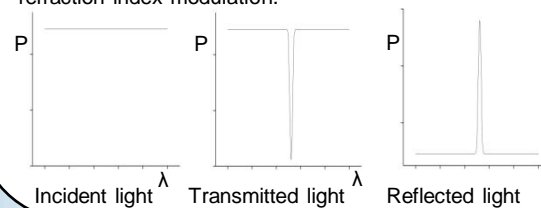


BRAGG GRATING IN SINGLE MODE OPTICAL FIBER

Bragg grating in single mode fiber acts as a highly wavelength-selective reflection filter with the wavelength of the peak reflectivity, λ_B , determined by the phase matching condition

$$\lambda_B = 2n_{eff} \Lambda$$

where n_{eff} is the effective refractive index of the guided mode in the fiber and Λ is the period of the refraction index modulation.



SENSING PRINCIPLES OF FIBER BRAGG GRATING

The sensing function of an FBG derives from the sensitivity of both the refractive index and grating period to externally applied mechanical or thermal perturbations.

The normalized strain response at constant temperature is

$$\frac{1}{\lambda_B} \frac{\Delta \lambda_B}{\Delta \epsilon} = 0.78 \times 10^{-6} \text{ }^{-1}$$

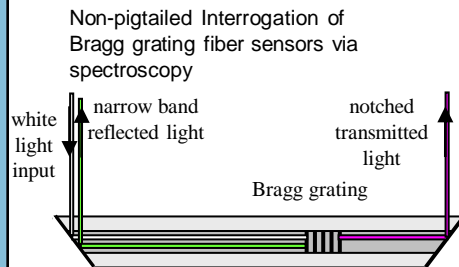
The normalized thermal response at constant strain is

$$\frac{1}{\lambda_B} \frac{\Delta \lambda_B}{\Delta T} = 6.678 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$$

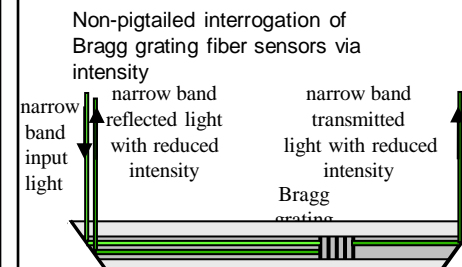
OPTICAL SENSORS EMBEDDED IN COMPOSITE STRUCTURES

Optical fiber sensors have great utility for integrity management and environmental sensing of composite structures, but suffer previously from cumbersome and fragile techniques for bringing the sensing light into the fiber since it had to be brought out of the composite (pigtailling).

NON-PIGTAILED INTERROGATION (SPECTROSCOPY)



NON-PIGTAILED INTERROGATION (INTENSITY)



EMBEDDED SENSOR NETWORK

FBG sensor network can be constructed inside composite structures to achieve a distributed measurement of strain and temperature.

ACKNOWLEDGEMENTS

This work is supported by the Army Research Laboratory through the Composite Materials Research program.