

Seminar

Institute for Plasma Research

Title: Design studies of apodized fiber Bragg grating for refractive index sensing applications
Speaker: Dr. Souryadipta Maiti
Banaras Hindu University, Varanasi
Date: 17th April 2025 (Thursday)
Time: 10.00 AM
Venue: Seminar Hall, IPR

Abstract

Optical fiber technology has evolved beyond communication, playing a crucial role in high-precision sensing due to its sensitivity, fast response, and immunity to electromagnetic interference. Fiber Bragg Gratings (FBGs) are particularly promising for refractive index sensing, offering compactness, multiplexing, and high resolution. However, conventional FBGs face challenges such as side lobe interference, broad reflection spectra, and environmental sensitivities.

This talk presents an in-depth investigation into apodized and tapered FBGs to overcome these limitations. Various apodization profiles—including Bessel, Blackman, and Gaussian—are analyzed, with Bessel apodization yielding a 278% sensitivity improvement over uniform FBGs. Introducing tapering, particularly exponential profiles, further enhances performance. The exponential tapered Bessel-apodized FBG achieves a sensitivity of 682.5 nm/RIU, reduced FWHM, and minimal group delay ripples, making it ideal for biosensing applications like cancer detection.

A novel Sine-Welch hybrid apodization approach is also introduced, emphasizing sharp spectral notches for improved detection accuracy. This design achieves an exceptional quality factor of 8919.04/RIU. Fabrication of FBGs performed through femtosecond laser technique. Overall, the study highlights how advanced grating engineering—via apodization, tapering, and hybridization—significantly enhances FBG sensor performance for real-time, high-accuracy refractive index sensing.
