Seminar

Institute for Plasma Research

Title : Studies on electromagnetic properties of multilayer/ coaxial circular waveguide

Speaker: Dr. Ankita Gaur
Institute for Plasma Research, Gandhinagar

Date : 29th September 2021 (Wednesday)

Time : 11.00 AM

Venue : Online - Join the talk:
https://meet.ipr.res.in/PDF_extensiontalk_Dr.AnkitaGaur

Abstract :

Coaxial circular waveguides can be used as light guiding devices and radiating devices. They find potential applications in antennas, phase-compensating or phase-shifting devices, backward wave oscillators, couplers, and fiber amplifiers, etc.

The dispersion and radiation characteristics of guided and leaky modes of the coaxial circular waveguides are studied in detail. **In our first study, we have carried out analytical and numerical studies of the dispersion characteristics of guided modes of metamaterial-based coaxial waveguide to realize the backward propagation characteristics.** A comparative study of the coaxial dielectric waveguide and metamaterial-based coaxial waveguide is carried out. The backwardwave characteristics for TE01, TM01 modes are achieved. This study could be useful for the various applications of backward waves e.g. backward wave coupler, phase compensating device, THz imaging. Also, numerical study shows the existence of super-slow wave region in metamaterial waveguide which is forbidden in the dielectric waveguide. **In the second study, the analytical and numerical studies of the complex dispersion characteristics of leaky modes of metamaterialbased coaxial waveguide are carried out to evaluate reactive mode region and antenna mode region for leaky mode antenna applications.** The existence of leaky modes above guided mode cutoff indicates that the physical behavior of metamaterial waveguide differs from dielectric waveguide where leaky modes exist below guided mode cut-off. The behavior of dispersion curves has been investigated by varying physical dimensions and constituent parameters (ε, μ). **In the third study, a full-wave analytical theory is developed for finding out the radiation characteristics of the coaxial dielectric waveguide antenna for leaky mode configurations**. For this study, we have used the polarization current method. The electric and magnetic field vectors are converted into rectangular coordinates and then, the value of electric and magnetic field vector potentials is derived, which is later transformed into spherical coordinates. The axial propagation constant value is obtained from dispersion characteristics of leaky mode.

In the fourth study, we have designed the dual-trench-assisted dual-ring doped EDFA for spacedivision multiplexing based optical communication system. The proposed fiber with fundamental pumping is used to study gain equalization of eight signal mode groups—LP01, LP02, LP11, LP12, LP21, LP22, LP31, and LP41. The results show that at 1530 nm signal wavelength, more than 20 dB gain with nearly 1 dB differential modal gain is achieved. The proposed fiber is capable of simultaneous amplification of 28 modes with nearly 1.54 dB gain excursion while maintaining sufficient mode spacing to avoid mode coupling due to macrobending.