Seminar

Institute for Plasma Research

Title : Slow Wave Characteristics of Metamaterial Loaded Helical Guide

Speaker : Mr. Dushyant Kumar Sharma
Institute for Plasma Research, Gandhinagar

Date : 04th November 2016 (Friday)

Time : 11.00 AM

Venue : Committee Room 3, (New Building), IPR

Abstract:

Slow Wave is an emerging area of research which promises many potential applications in the field of Optical Communication Network (OCN) [1-3], Microwave Photonics (MWP) [4] and Tele communication Network. In order to realize OCN architecture the Optical Data Packet Switching (ODPS) is highly desirable [1]. For ODPS, it is necessary to synchronize incoming data packets and regulate data traffic at network nodes or to implement congestion and contention resolution in the core routers [1]. Nowadays, electrical router performs these operations through large banks of Static Random Access Memory (SRAM). In OCN architecture this activity will be performed by optical buffers and memories. The mechanism of slow wave is vital for the development such devices.

This thesis work is devoted to analyze the slow wave behavior of helical waveguide when its characteristics (structure induced dispersion) are superimposed with metamaterial properties (material induced dispersion). Different configurations of helical waveguide embedded with metamaterial medium are investigated and discussed. Significant amount of phase velocity reduction has been achieved in comparison to normal helix waveguide when it is in free space or loaded with normal dielectric column. The waveguide supports Hybrid (HE) mode propagation and possesses characteristics of Backward Wave (BW) mode, Forward Wave (FW) mode, zero-group velocity and mode-degeneracy. The large value of effective index of BW mode and mode-degeneracy mechanism leads to slowing and trapping of Electromagnetic (EM) wave. We, also, report that helical waveguide physical dimensions mainly radius and pitch angle act as tuning tools to control the phase velocity.

References:

[1] E. F. Burmeister, D. J. Blumenthal, J. E. Bowers, “A comparison of optical buffering technologies,” Optical switching and networking, 2007.

[2] Rodney S. Tucker, “The Role of Optics and Electronics in High-Capacity Routers,” Journal of light wave technology, Vol. 24, No. 12, 2006.

[3] Rodney S. Tucker, P. Ku and C. J. Chang-Hasnain, “Slow-light optical buffers: capabilities and fundamental limitations,” Journal of light wave technology, Vol. 23, No. 12, 2005.