Seminar

Institute for Plasma Research

Title : Study of backward waves using DNG metamaterial based coaxial waveguide

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Date : 22nd September 2020 (Tuesday)

Time : 11:00 AM

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

Abstract :

Metamaterials are artificially designed structures that build from periodically arranged unit cells, having periodicity much smaller than the incident/ guiding wavelength. These can be designed and engineered for negative permittivity and permeability simultaneously. Metamaterials based waveguide or structures could be an effective way to realize backward waves, which find potential applications in backward-wave oscillators, travelling-wave amplifiers, frequency selectors, phase-compensating or phase-shifting devices etc..

We have analysed and designed a double-negative (DNG) metamaterial based coaxial waveguide and studied its dispersion characteristics to realize the backward propagation characteristics. The electromagnetics of guided modes of the proposed structure is studied in detail. Characteristic equations or dispersion determinants of guided modes (TE, TM and hybrid) are solved numerically by Muller method. A comparative study of the proposed structure with its counter-part dielectric is also carried out. In the case of dielectric waveguide, all modes show forward wave characteristics due to positive slope of the normalized propagation constant with normalized wave vector. The dispersion characteristics for the proposed structure show that TE01, TM01, EH11 modes have negative slope of the normalized propagation constant with normalized wave vector. It means by introducing metamaterial layers in an optimum manner, we have achieved the backward-wave characteristics for the principal (TE01, TM01, EH11) modes. The proposed structure could be useful for the various applications of backward waves in the microwave domain.