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Seminar

Institute for Plasma Research

Title : Investigation of TM01 mode analysis in circular waveguide for High power microwave plasma interaction applications and other activities

Speaker: Dr. Uttam Kumar Goswami
Institute for Plasma Research, Gandhinagar

Date : 12th January 2021 (Tuesday)

Time : 02.00 PM

Venue : Online - Join the talk:

<https://meet.google.com/ets-qwmr-mwk>

Abstract :

In the investigation, the research has been focused on TM01 mode based high power microwave (HPM) experiment for SYstem for Microwave PLasma Experiments (SYMPLE). As the HPM electric field should be along the plasma gradient direction, the mode should be TM01 and the coupling components need to be compatible with circular waveguides. The analysis is focusing the operational points like how a TM mode can be generated and propagated in a guide.

Two fully functional programs have been developed to analyse the characteristic parameters as well as outcomes for TM01 circular wave-guide and TE10 rectangular wave-guide. The results give operating frequency band, guided wavelength, electric field, magnetic field intensity, power propagation etc. The conclusion achieved by the programming has also been verified by the 3D Full-wave EM solver and found that results are well matched with each other.

As an application note of TM01 mode, the experiments for the termination of insects from the night-blooming jasmine tree are conducted successfully by an in-house developed microwave system (2.45 GHz, 1kW). The conical horn is used as an applicator/launcher to irradiate the microwaves for few minutes to expose the insects.

In additional development, the A/D interface has been developed to drive the ECR source (2.45 GHz, 2kW CW/Pulse) required in ADITYA-U for vacuum vessel wall conditioning experiments. The ECR source has been tested using a provisional A/D circuit board and found effectively functional. The packaged A/D circuit is in final phase of development, which has the remote control to monitor the forward & reflected power.

Analytical studies of microwave shielding, which is required for the SYMPLE experimental set-up has been performed. The different techniques have been explored to block the EM fields and to achieve an efficient shielding effectiveness (SE) around 40 dB both for electric and magnetic field.

The design simulations of nth order choke (filter) has been done in the Finite integral method based EM Solver, aiming to avoid critical situation of unforeseen possibilities for break-down occurrences in the vessel window & human safety aspects required for SYMPLE experiment.
