

Determination of Reflection Coefficient for ICRH Transmission Line Using Non-Linear Least Square Technique

Abstract

Objective

In Ion Cyclotron Resonance Heating (ICRH), coupling of RF power to antenna has been a concern. Plasma impedance may change during the duration of plasma discharge. In order to effectively couple RF power, it is essential to know the impedance seen by the antenna. VSWR curve technique is used to know this impedance. Voltage probes are installed on the transmission line. VSWR curve is drawn using these voltage signals. But these signals may carry error which may get introduced due to different reasons. Error may get introduced into the probe signal because of non-uniform probe penetration into the transmission line. Cables used for transferring the signal from probe to data acquisition rack may have different attenuation because of manufacturing variations. Connectors being used may have different insertion losses. All these contribute to variation in the signals received at the data acquisition rack. Non-linear least square fitting technique is used to minimize the total error. Non-linear technique is used because of the non-linear nature of the VSWR curve. A known load is connected to simulate plasma load. 50 Watt of RF power is fed to the line. The line used is of 3 1/8" size. Probes are installed on this line. Using data acquisition system, probe data is fed to the program made. The program uses least curve fitting method to fit the VSWR curve in the raw data. The load is calculated from VSWR curve. The load so calculated is compared with the known load to compare the capability of this technique to determine unknown load.

Scope of Work:

Understanding impedance matching requirement in RF

Theoretical formulation of the problem

Simulation of the impedance determination and the error minimization

Performing the experiment for validation of the technique

Requirements:

1. No. of the students: 1
2. Stream: B.Tech. (Electronics & Communication/Electronics/Instrumentation)
3. Duration: 6 months

Expected Outcome: Determination of plasma impedance.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: B.E./B.Tech. Electronics and Instrumentation Engineering

3) Academic Project duration:

(a) Total academic project duration: 6 Weeks

(b) Student's presence at IPR for academic project work: 3 Full working Days per week

**Email to: raj@ipr.res.in[Guide's e-mail address] and
project_ece@ipr.res.in [Academic Project Coordinator's e-mail address]**

Phone Number: 079 -+917923962090 [Guide's phone number]