

Modeling and simulation of magnetic diagnostic signals in SST-1 using INDUCT code

Abstract

The study explores the evolution of magnetic diagnostic signals due to the active coil currents, plasma currents and induced toroidal eddy currents in SST-1 passive structures using a toroidal-filament model implemented in INDUCT code [1]. Magnetic probe signals at six locations in SST-1 need to be simulated and compared with experimental data to support the future SST-1 experiments in terms of magnetic diagnostics which will be used for reconstructing the real time MHD equilibrium. Further a Simulink module has to be developed and integrated with the existing simulink model to provide a dynamic visualization of eddy current evolution and its effects on magnetic diagnostics. The project is planned as per the following sections:

Understanding the INDUCT Code (MATLAB, SIMULINK)

Analyze the existing MATLAB code that models the tokamak coil systems including toroidal eddy currents and plasma current.

Understanding the key functionalities: current evolution, voltage induction, and magnetic diagnostics signals.

Identify where modifications are needed to include magnetic probe signal calculations.

Magnetic Probe Signal Simulation and Comparison

Determine the mathematical formulation to record the probe signals based on both active and induced current generated magnetic fields.

Implement magnetic field calculations for six probe locations using the numerical methods.

Validate simulated probe signals using experimental data.

Adjust model parameters if necessary to improve accuracy.

Simulink Model Development

Develop a Simulink module to simulate the time evolution of toroidal eddy currents.

Integrate probe signal calculations into the Simulink framework.

Allow for parameter tuning to match experimental observations.

Deliverables

MATLAB script with extended probe signal calculations.

Plots comparing simulated and experimental results.

Simulink model demonstrating the time evolution of eddy currents and probe signals.

Reference

[1] 10.1016/j.fusengdes.2018.01.016

Academic Project Requirements:

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

2) Name of course with branch/discipline: B.Sc. Physics

3) Academic Project duration:

(a) Total academic project duration: 8 Weeks

(b) Student's presence at IPR for academic project work: 4 Full working Days per week

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