Application of Finite Element Electromagnetic Modelling to Magnetic Diagnostics in Toroidal Plasma Devices

Abstract

Magnetic diagnostics form an essential component of toroidal plasma experiments, providing information on current distributions, magnetic field structure, and electromagnetic coupling within the device. This project focuses on the application of Finite Element Method Magnetics (FEMM) to model electromagnetic phenomena relevant to magnetic diagnostics in toroidal plasma systems. The work includes the construction of axisymmetric models of toroidal current-carrying conductors, calculation of magnetic field distributions and magnetic contour plots, estimation of self- and mutual inductances between current-carrying elements and diagnostic sensors, and evaluation of magnetic probe and flux-loop responses. The influence of conductor geometry, current distribution, sensor placement, and surrounding conducting structures on the measured magnetic signals will be investigated through numerical simulations. Finally, synthetic diagnostic signals will be attempted to generate and will be compared with available experimental measurements, providing a computational framework for understanding and interpreting magnetic measurements commonly employed in toroidal plasma devices.

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: 18 Weeks
(b) Student's presence at IPR for academic project work: 1 Full working Days per week

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