Simulation study of plasma control power supply for fusion devices

Abstract

Research on nuclear fusion power plants have evolved to a great extent over the last decade and plasma stability is a key parameters for an efficient and viable commercial application of fusion. Maintaining plasma stability in fusion devices, such as tokamaks, requires ultra-fast and precise modulation of magnetic fields to counteract instabilities like Vertical Displacement Events (VDEs). This project presents the design and simulation of a high-performance power supply system specifically engineered for plasma magnetic control. The study focuses on a Multi-Level Converter (MLC) topology, chosen for its ability to provide high-voltage slew rates and low harmonic distortion. Using MATLAB/Simulink, the simulation evaluates a control strategy employing a robust controller optimized via pulse-width modulation (PWM) techniques. Key performance indicators include response time, current ripple reduction, and dynamic tracking accuracy under varying load conditions. This research provides a framework for developing next-generation power electronics essential for the commercial viability of nuclear fusion energy.

Academic Project Requirements:

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

2) Name of course with branch/discipline: B.E./B.Tech. Electrical

3) Academic Project duration:

(a) Total academic project duration: 10 Weeks
(b) Student's presence at IPR for academic project work: 3 Full working Days per week

Email to: aritra.chakraborty@ipr.res.in[Guide's e-mail address] and
project_ee@ipr.res.in [Academic Project Coordinator's e-mail address]

Phone Number: 079 -4404/2271 [Guide's phone number]