Study and design a Feasible Strategy for Controlling of the Initial Phase of the Vertical Field Current Profile in ADITYA-U

Abstract

The Vertical Field (VF) current profile plays a crucial role in tokamak plasma operation, as it directly influences plasma equilibrium and the plasma current evolution throughout the discharge pulse. In particular, during the initial plasma current ramp-up phase, maintaining a stable plasma column and proper equilibrium is essential for achieving reliable and high-performance plasma operation.

To support the rapid rise of plasma current during this phase, the VF current must also increase at a sufficiently high ramp rate. At present, the VF Power Supply (VFPS) in ADITYA-U employs a 12-pulse thyristor-based converter in conjunction with a pre-charged capacitor bank. Although the existing configuration is capable of generating predefined discharge profiles, it has limitations in achieving the higher initial current slope required for enhanced plasma current operation.

Preliminary attempts, including the use of series-connected pre-charged capacitors, have shown promising results; however, further investigation and optimization are required to develop a practical and reliable solution.

Objective
The objective of this project is to investigate and develop a feasible solution for improving the initial ramp-up phase of the VF current profile in ADITYA-U. The study will involve detailed simulation and analysis using actual experimental data. Subject to satisfactory simulation outcomes, the proposed solution may also be considered for practical implementation.

Scope of Work

1. Develop simulation models using tools such as MATLAB/Simulink to study the VF current ramp up profile.

2. Propose and validate suitable techniques to enhance the initial VF current ramp rate while maintaining the existing source voltage constraints.

3. Evaluate the feasibility and practical implementation aspects of the proposed solution.

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

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

Phone Number: 079 -2270 [Guide’s phone number]