

# Transient dynamic study for grid connection of large fusion reactors

## Abstract

This project investigates the transient dynamic stability of integrating large-scale nuclear fusion reactors into the synchronous power grid. Unlike conventional plants, fusion reactors—such as large-scale tokamaks—impose unique challenges due to their pulsed power nature and high-capacity magnetic confinement systems. The study utilizes simulation models to analyze the impact of sudden load fluctuations and reactor dynamics on grid frequency and active power oscillations. A primary focus is placed on the electromechanical interactions between the fusion plant and nearby thermal units. We evaluate the resulting transient torque and rotor speed deviations in synchronous generators which effects the mechanical fatigue. The results provide a technical framework for establishing grid-code compliance for future fusion power projects, ensuring they contribute to, rather than compromise, system inertia and stability.

## 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]