Seminar

Institute for Plasma Research

Title : Study on Plasma Shaping and Control in Steady State Superconducting Tokamak (SST-1)

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Date : 21st July 2017 (Friday)

Time : 10.30 AM

Venue : Seminar Hall, IPR

Abstract :

The present study is a maiden attempt in the first Indian Steady State Tokamak (SST-1) addressing some of the fundamental aspects of plasma initiation, elaborating the favourable and unfavourable combinations of the influencing vacuum fields, the initial shapes and subsequent plasma evolution, the preliminary characteristics of the formed toroidal plasma column and some preliminary plasma controls leading to elongation of the ohmic plasma pulse etc. This study has been very intimately interlinked with the plasma operational experiments which have been carried out in the SST-1 device during 2013-2016. The spectrum of these scientific investigations can be divided into two broad categories: The first part addresses the basics of plasma formation in SST-1 and its subsequent evolution as per the prevailing constraints of the SST-1 device. The role of the eddy currents in influencing plasma formation and evolution characteristics as seen in several SST-1 shots have been explained. Apart from explaining the observed plasma shots, desirable steps towards increasing the plasma current have also been investigated in this study. In a study related to off-axis field computations using finite element modelling, eddy current characteristics have also been analysed. Once the plasma column is formed, its basic radial movements and shifts have been computed employing experimental data obtained from the internal probes and loops. The resulting flux surfaces have also been computed using the well established Grad-Shafranov formalism under certain conditions, assuming the plasma column to be circular in cross sectional shape. The shifts of the plasma column have also been benchmarked with imaging diagnostics data.

The next module studies the factors and measures that would improve the performance specifically of the duration of the SST-1 ohmic plasma. The usage of magnetic diagnostics in the studies of the plasma shifts, flux surface and its possible exploitation towards position control of the SST-1 circular plasma have been investigated. A simple feedback loop concept and its implementation towards position control using the vertical magnetic field and shift calculated from EM diagnostics have been explained. This study is important for the generation of useful inputs towards implementation of a robust and precise feedback control system that would contribute towards the long-duration confinement of the SST-1 plasma column in the future.