

Abstract

With the advancement of developing technology for achieving fusion energy as the viable global energy source, the events of launching projects to develop advanced fusion devices are on their way in almost all countries. Tokamak is a Russian acronym for toroidally confined magnetic device for producing and confining plasma. Recent tokamaks are built with an aim to confine plasma for a long pulse duration of about 1000 seconds or more. Such an experimental plasma fusion device to operate at steady state called Steady State Superconducting Tokamak-1 (SST-1) is being developed at the Institute for Plasma Research, India. The machine will be operating with a hydrogen plasma for a steady state operation of 1000 seconds pulse with the help of superconducting electromagnets and related technologies. From the history of existing tokamaks, it is obvious that the electromagnetic loadings due to plasma instabilities are highly detrimental in nature. These electromagnetic loads are the design drivers for all the subsystems components and supporting structures of all subsystems of the tokamak.

As a part of dissertation work, a detailed study on the Electromagnetic analysis for induced currents produced on the PFCs due to the change in position of plasma due to instabilities. The distribution of current densities are crucial for the design of current leads. To evaluate the exact current densities and the amount of heat load that will be generated during conduction, which will be a critical input to the liquid helium consumption, which needs to be reduced to the minimum possible value. The work involves the theoretical back for the compute mechanism to compare the analysis results.

The halo currents are the partial plasma currents that are passed on to the surrounding conducting during the plasma instabilities. Halo current simulation using electric circuit analysis with the geometry modeling and meshing of components. The project work has to evaluate the exact halo currents that will be induced on the components. The works also involves the theoretical back for the complete mechanism to compare the analysis results.

ANSYS is the software that has been keenly programmed with many sorts of problems in electromagnetic. ANSYS gives more accurate and better solution for the actual geometry in existence. The project work has to evaluate the exact currents that will be induced on the components with the actual modeling of geometry and with a mapped meshing. The works also involves the theoretical back for the complete mechanism to compare the analysis results.