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Seminar

Institute for Plasma Research

Title : MHD flow inside ducts: two phase flow analysis

Speaker: Dr. Abin Rejeesh
IIT Bombay

Date : 21st March 2022 (Monday)

Time : 03.30 PM

Venue : Online - Join the talk:

https://meet.ipr.res.in/Dr.AbinRejeesh_PDFTalk

Abstract :

The duct flow of two immiscible, electrically conducting fluids with an imposed steady magnetic field is nearly optimal for analysing the physics of liquid metal fluid flows happening inside a blanket module as well as the technological implications happened in the past experiments in nuclear fusion reactors. The proposed ITER reactor aims to generate electricity from deuterium-tritium (D – T) plasma confined using strong magnetic fields ($\sim 5T$). Outside the helium-cooled walls that contain the D –T plasma lies the Test Blanket Module (TBM). Due to MHD effects, these blanket are subjected to huge pressure drop, turbulence modifications and changes in heat transfer. These blanket modules are multi functional [1]: in the first place, it should absorb the neutron flux emitted from the fusion materials and convert the kinetic energy of the neutrons into heat, which can then be used to drive a classical turbine process to produce electricity. Liquid metals are the candidate coolant liquids since it can be operated at high temperature and have high thermal conductivities. The second function of the blankets is to protect the magnetic field coils from intense, damaging neutron and high energy radiations. Finally, the liquid coolants acts as a breeding material by providing tritium from the chemical reaction of lithium which is already present in the liquid metal (lead-lithium (Pb-17Li) eutectic) needed for the fusion reaction. The Deuterium-Tritium based fusion reactors involves large helium production rates in the breeding blankets. The particular motivation for this study is the accident scenario of the leakage of helium gas into the PbLi flow. Hence the fluid flow inside a blanket module is no longer treated as a single phase fluid model. This might create an impact on the conceptual design of diverse fusion power reactor units, such as Liquid Metal blankets which could affect temperature sinks in liquid metal channels.

Keywords: Liquid Metal flows, MHD equations, Induction formulation, Induction-less formulation, intermhdFoam, interepotFoam.
