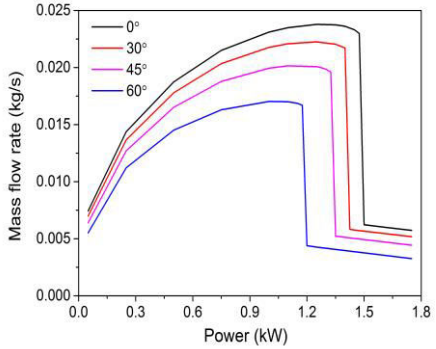
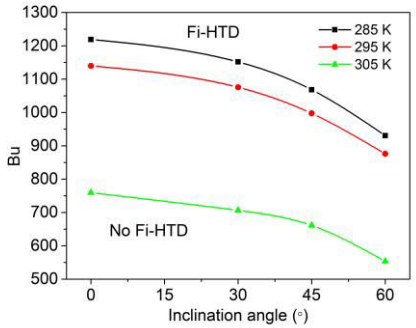
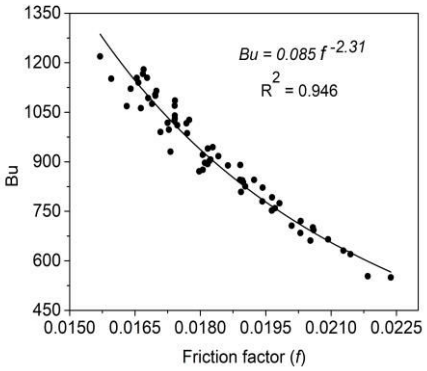
EXPERIMENTAL AND COMPUTATIONAL ANALYSIS OF FLOW-INDUCED HEAT TRANSFER DETERIORATION IN SUPERCRITICAL NATURAL CIRCULATION LOOP – SERB (DST)

Principal Investigator – Dr. Dipankar Narayan Basu (Dept. of Mechanical Engineering)







Objective

1. Design and development of experimental facility for rectangular natural circulation loop with supercritical CO_2 as the working medium and systematic experimentation to investigate the role of associated geometric and operating parameters on FiHTD.
2. Transient and stability analysis with 1-D model to correlate the initiation of FiHTD with stability threshold.
3. Computational exploration of options to delay the appearance of FiHTD and preparation of working-regime maps to identify safe range of operating variables.

Deliverables - Stability threshold and Guidelines for safer operation of sNCL. Study of role of buoyancy, friction force and thermalhydraulic behavior of sNCL using steady state 3D simulation, 1-D stability code and Experiment investigation.

Noteworthy achievements –

1. Observation of sharp drop of flow rate after FiHTD.
2. prediction of onset of FiHTD with the help of Non-dimensional buoyancy parameter and Reynolds number.
3. Change of slope of friction factor from negative to positive demonstrating complete dominance of friction force after FiHTD.
4. Obtained general trend for buoyancy vs friction factor using power law.