Final report for OpenFOAM Summer Fellowship 2025

LES Simulations of turbulent flow in a trough and detailed comparison with DNS simulations

Submitted by: Subhrajit Majumder

Project Guide - Prof. Manaswita Bose

Project Mentor: Nikhil Chitnavis

Abstract

The motive behind this study is to describe the nature and behaviour of a turbulent flow in a trough using Large Eddy Simulation(LES). Periodic boundary conditions were implied at the inlet and outlet to create a fully developed turbulent inflow condition without giving a long upstream domain. Geometry and mesh has been developed using the "blockMesh" function of OpenFoam utility. A RANS simulation using the "kEpsilon" model has been done on the same geometry to calculate the integral length scale to check for mesh refinement. LES simulation is then done using "WALE" model. The flow has been solved using "pimpleFoam" solver available in Openfoam Utility. Flow separation occurs in the step leading to the formation of recirculation zones along with low velocity zones and shear layer development that can be observed from the Q-criterion. Vortex shreding are observed to get strengthen with respect to time and streamwise velocity flactuations seemed to dominate over velocity flactuation.