NUMERICAL SIMULATION AND CHARACTERIZATION OF SWIRL FLUID MOTION THROUGH CYLINDRICAL CHAMBERS

A.S. Karthika
Department of Mechanical Engineering
Government Engineering College
Barton Hill
Trivandrum-695 035, India

S.S. Suneesh
Department of Mechanical Engineering
Government Engineering College
Palakkad-678 633, India

S. Anil Lal
Department of Mechanical Engineering
College of Engineering Trivandrum
Trivandrum-695 016, India
Email : anillal65@gmail.com

T. Jayachandran
Department of Aerospace Engineering
Indian Institute of Technology Madras (IITM)
Chennai-600 036, India

Abstract

Axisymmetric solution of radial, axial and tangential components of velocity of flow through a cylindrical chamber with an inflow containing swirl and outflowis investigated numerically using Finite Volume Method. An in-house developed computer code for solving the three components of velocity and pressure is developed and validated using experimental data available from literature on the problem of axial vortex breakdown of confined flow in a cylinder due to rotation of one of the end walls. The code uses a staggered approach and fractional step projection method for decoupling the velocity and pressure. The convection and diffusion terms are approximated using a second-order accurate central difference scheme. This paper discusses the characteristics features of flow such as mixing streams, streams of fluid flowing close to the solid walls (cooling streams), swirl motion and development of flow structures.

Keywords: Swirl Flow, Cooling Stream, Mixing Stream, Recirculating Eddy, Vortex Breakdown