FOSSEE, IIT Bombay
OpenFOAM Case Study
Project
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Air Residence Time analysis for Nuclear lab in IITB with and without AC

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Abstract

Indoor air quality and occupant comfort are paramount considerations in built environments, particularly in spaces equipped with ventilation systems featuring exhaust, inlet, and air conditioning (AC) units. Understanding the air residence time, the average duration air particles remain within a room before being exchanged, is essential for effective ventilation design and pollutant mitigation strategies. This study employs computational fluid dynamics (CFD) techniques to analyses airflow patterns and temperature distributions in a room with one exhaust, one inlet, and two AC units. The simulation process encompasses geometry definition, mesh generation, solver setup, and post-processing analysis. Through meticulous simulation and post-processing, the air residence time is computed by evaluating the volume of the room relative to the total volumetric flow rate of air entering or exiting the space. The findings of this study offer insights into optimizing ventilation strategies, and reducing Air Residence Time.
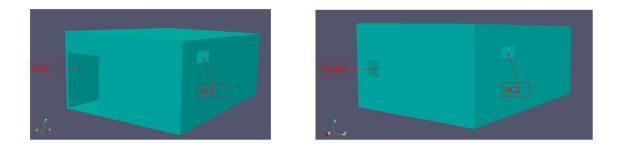

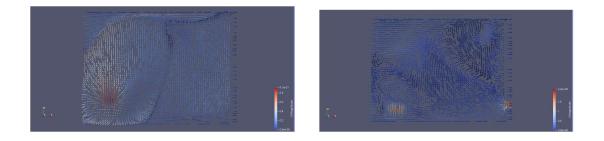Figure 1: Dimensions of the Nuclear Lab, IIT Bombay

Figure 2: Velocity Vectors at 0.2 m and 1.35 m height for the Two AC Condition

References:

[1] Wilcox, D. C. (1998). Turbulence modeling for CFD. La Canada, Calif: DCW Industries.

[2] Nguyen, V.-B., Do, Q.-V., & Pham, V.-S. (2020). An Open-FOAM solver for multiphase and turbulent flow. In Physics of Fluids (Vol. 32, Issue 4, p. 043303). AIP Publishing.

[3] Ventilation Analysis of Nuclear Lab, IIT Bombay for Open-Foam Documentation.