Improving air quality in classrooms using ART and using ML to expedite simulation results

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Abstract

The objective of this case study is to study air flow patterns that exist in a classroom environment consisting of two adjacent split air conditioners and two exhaust fans. One of the exhaust fans has a fixed location and the other one is moved around the room. Further, these flow simulations will be used to find out the maximum air residence time for a given case with the aim to minimize it. To ease the process of estimating air quality, a machine learning neural network model will be trained to predict the maximum air residence time for a particular configuration of exhausts in a classroom environment. Lastly, an intervention which can modify the flow pattern and hence the air quality is proposed to further minimize the maximum air residence time in that configuration of exhausts that produced the minima. The project aims to make classroom ventilation design easier and standardized for any given room with similar air inlet and outlet conditions. The simulator used for all simulations in OpenFOAM 9.

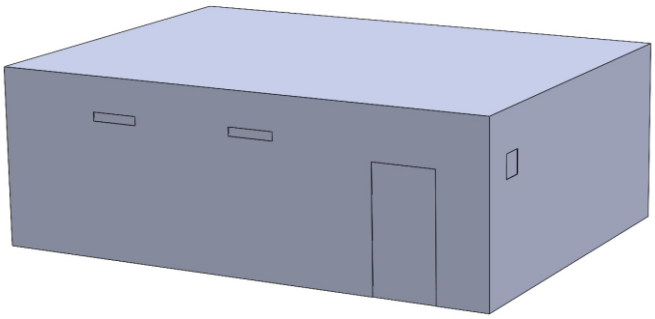

Figure 1: A pictorial depiction of the classroom model.

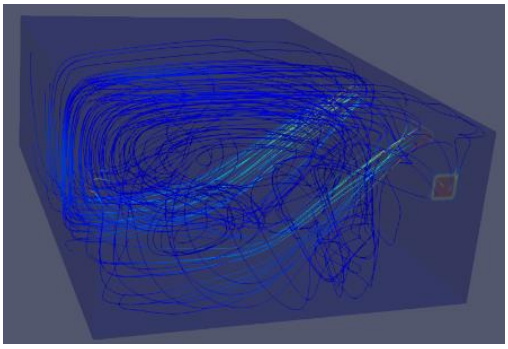

Figure 2: Velocity streamlines for demonstration purpose only

References

Fluid-Mechanics-101. (2021). *Calculators and tools*. https://www.fluidmechanics101.com/pages/tools.html (accessed: 10.04.2024).

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