Modelling and Simulation of Natural Ventilation Provision of a Computer Lab for Energy Management Analysis and Applications

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The Proposed research, we investigate the air flow distribution in the computer laboratory room which is under the tropical natural ventilation circumstances. The investigation has been directed to develop a 3D Computational Fluid Dynamics model for the computer room. Rendering and computational calculations are handled by finite element methods for modeling and simulation of the proposed analysis. Physics of Turbulent Flow combined with k-ε model and commercial version of COMSOL Multi-physics® were used for the simulation. While laminar flow pattern was considered and used for the primary simulation, simulation has been given to be converged in objects under steady state conditions. Open windows and doors in different orientations were taken as inlets and outlets for studying the behavior of natural ventilation system. The inlet velocity is provided to be in between 2 m/s – 3m/s, varying with time were simulated. The velocity distribution of air was obtained by solving the continuity and momentum equations of transport phenomena. Investigation carried out under Sri Lankan environmental parameters. However, the simulation has not been given an acceptable convergent when the inlet velocity is increased beyond 3 m/s, for turbulent k-ε flow model. Results are verified with the literature given for experimental results under similar orientation of objects and ventilation setups with 97 % confidence, including 12 personal computers with six 1200 KVA UPS and 15 human sources of heating at constant rate. This primary study is expected to be used in energy audits and management analysis in the directions of green-building setups towards utilizing natural ventilations in universities by reducing the number of Air-conditioner units in new buildings and also which are currently being under operation. Turbulent air flow and heating will be studied under different and extended fluid dynamics model as next step of the extended research.

Key words: Turbulent Flow, air flow distribution, laminar flow, natural ventilation, CFD Computational Fluid Dynamics, Multi-physics