Study of Natural Ventilation Design by Integrating the Multi-zone Model with CFD Simulation

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Natural ventilation is widely applied in newly designed buildings because it has the potential to significantly reduce the energy cost required to mechanically ventilated buildings. Natural ventilation relies on the wind force and the buoyancy force to keep a building cool. Several methods provide the quantitative way to predict the performance of the natural ventilation design: experiment measurement, analytical model, multi-zone model, and computational fluid dynamics (CFD) method. The objective of this work is to combine the advantages of both the multi-zone model and the CFD simulation in order to accurately and quickly assess the natural ventilation design. The contributions of this thesis include two main parts:

- ♣ Develop a new program by coupling the multi-zone airflow and thermal model for natural ventilation prediction.
- ♣ Investigate the strategies of how to integrate the multi-zone model with the CFD simulation.

In order to provide a convenient way to use the MMPN program, a web-server (http://18.80.1.118:8080/mmpn/start.htm, still under development) was developed in during this thesis research. Four typical building scenarios were designed for user choice: atrium aided, wind-scoop aided, single-sided and cross ventilation buildings. The MMPN program will automatically generate the zone division and the network before it operates the calculation. The MMPN program provides virtual graphs for user to examine the calculating results. In addition to the building scenarios, the user also can define a more complicated case using user-self-designed case function.

Figure 1 Integrating the multi-zone model with CFD simulation for natural ventilation

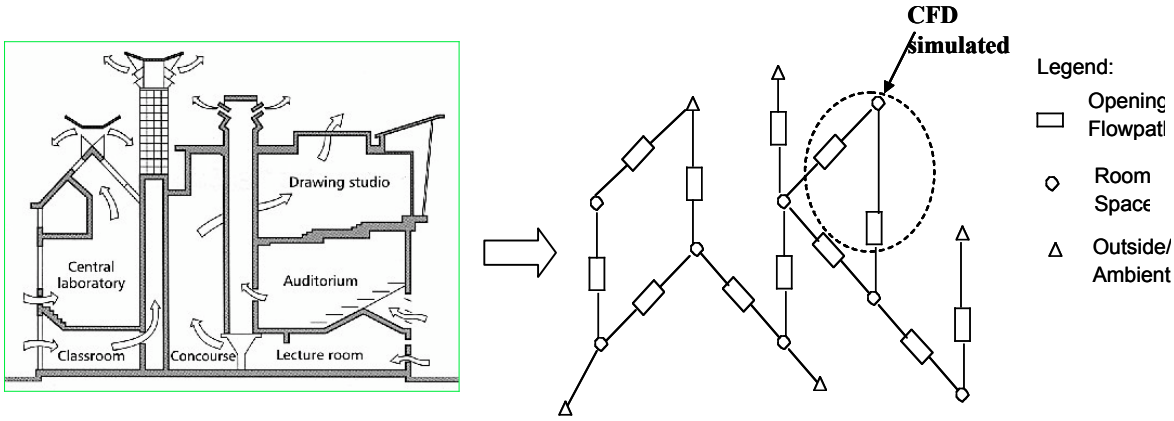

Figure 2 Web-server of the MMPN program