Chapter 8 Closure

This chapter provides a brief overview of the work and contributions of this study. It also provides recommendations for future work.

8.1 SUMMARY

Building designers are increasingly pressured to design buildings with high standards of energy efficiency, performance and comfort. Computer design tools have a huge potential for aiding designers in achieving these design objectives. These tools have so far failed to be incorporated into general design practice. Complexity of existing tools seems to be the biggest stumbling block. A need for simplified design tools that aid designers in improving the thermal efficiency of buildings and selecting a preliminary HVAC system was identified.

Thermal efficiency of a building is largely determined by architectural design decisions made during the preliminary design stages. A new simplified design tool was thus developed for use by architects. In order to simplify the tool it was necessary to reduce input complexity and data required by the tool. This was done by identifying and focusing on critical design parameters. A rating scheme was also developed to further facilitate the evaluation of building thermal performance. The new tool was extensively verified and tested to establish confidence and credibility in its use.

HVAC system selection requires a detailed analysis to compare and evaluate the different system characteristics. This is however hardly ever done, as it is complex and very time consuming. A simplified preliminary selection tool was developed to aid designers in this respect. The new tool improves on other existing tools by combining the simplicity of numerical ranking methods with the proficiency of expert systems. The tool further enhances communication between the designer and building developer by incorporating the whole team in ranking the importance of attaining certain design goals.

In order to demonstrate their function, the above mentioned simplified design tools were applied to design a hypothetical office building. Using these tools it was possible to perform an extensive building and system analysis without the need for detailed information. The influence that various architectural design decisions have on thermal efficiency was analysed. Results indicate that there is approximately a 60% difference in HVAC system size between the worst and best building configuration evaluated.

The main benefits of the selection tool are that designers do not focus only on familiar systems, and that the tool aids HVAC designers in establishing the needs and requirements of the building developer.

This study shows that design tools need not be complex or difficult to use in order to be beneficial to designers. It is believed that the new tools will contribute to improving building efficiency and comfort without further complicating the existing design methodology. The study objectives identified in Chapter 1 have thus been successfully addressed.

8.2 RECOMMENDATIONS FOR FURTHER WORK

The simplified design tools developed during this study can greatly assist practising designers. Certain aspects of their function and use can however be improved. These items are identified here as areas for future work.

1. The verification analysis indicated that the simplified design tool has the potential to be used in more detailed analysis. It is proposed that the preliminary design tool be integrated into a detailed design tool. The initial building model is generated using the simplified user interface. An advanced user can edit the model where necessary via a detailed user interface. This will mostly consist of providing detailed ventilation and internal load data. This enables engineers to also benefit from the simplified building description.

2. The exchange of data between different design applications was identified as one of the requirements of new design tools. Currently, the new thermal design tool does not make any provision for this. This aspect still needs to be addressed.

3. Natural lighting is also influenced by architectural design decisions. Reducing window size, for example, may improve the thermal characteristics of the building but it can adversely affect savings due to the use of natural lighting. A simplified method for taking this into considerations must be developed.

4. The rating scheme developed during this study uses the normalised average of the heating and cooling system requirements as basis for determining building efficiency. However, buildings subject to warm climatic conditions for the largest part of the year need to be more efficient towards reducing the cooling load, and visa versa. The rating scheme can be improved by using a weighted ratio of the winter and summer requirements. The number of heating and cooling days for a particular climate can typically be used as weighing factor.

5. The building thermal rating scheme must be extended to incorporate the other building types.

6. The selection tool prototype developed during this study currently only evaluates and rates a few generic cooling system types. There is thus a huge scope for extending the tool to include new system types and selection criteria. Another aspect that needs attention is the use of multiple systems. Currently the selection tool does not take this into account. It is however a common HVAC system solution.