Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Ghazel Masah
Student number	4349792

Studio		
Name / Theme	Architectural Engineering Graduation Studio/ Make	
Main mentor	Stephan Verkuijlen	Architecture
Second mentor	Lex van Deudekom, Feras Alsaggaf	Building Technology
Argumentation of choice of the studio	It offered more flexibility in choosing a location compared to other studios and allows for technology-driven design. I also appreciate that everyone is working on different projects, making the themes more diverse and engaging to discuss.	

Graduation project	
Title of the graduation project	Designing for Comfort: a computational design framework
Goal	
Location:	Kuala Lumpur, Malaysia
The posed problem,	In tropical regions like Malaysia, the lack of climate-responsive design in modern buildings leads to high energy use and poor thermal comfort, highlighting the need for computational methods to optimize passive cooling strategies.
research questions and	How can computational design methods be systematically applied to evaluate and improve thermal comfort of buildings in the tropics?
design assignment in which these result.	Mixed-use high rise building in KL, Malaysia.
The design assignment is to apply the computational design framework developed through the thematic research to design and test a high-rise mixed-use building in Kuala Lumpur, in order to demonstrate improved thermal comfort and reduced energy use.	

Process

Method description

In this research, I begin with a literature review to understand how past studies have tackled the use of computational design to enhance thermal comfort, many of which focus on just one aspect, like shading or ventilation. I aim to go a step further by looking at how these elements interact and can be optimized together.
Based on these insights, I develop a design framework (during the research phase) that brings together different aspects of computational design to assess and improve comfort while reducing energy use. To keep the research grounded, I will use a real high-rise building in Kuala Lumpur as a case study. For the design phase I'll create my own design proposal using the design framework from the research phase.
Throughout the process, I combine what I learn from literature and local context with simulation data. By testing and refining these ideas through design, my goal is to create a framework that is not only rooted in theory but also useful for real-world applications and to see whether computational design can aid thermal comfort and energy efficiency.

Literature and general practical references

The following list shows a selection of literature and standards that I intent to use. Furthermore I am using the ladybug tools suite for the algorithms needed for simulation. I also intend to use the CumInCAD research database that contains publications about computer aided architectural design. It also offers relevant case-studies.

Awbi, H. B. (2003). *Ventilation of buildings* (2nd ed.). London: Spon Press.

Aynsley, R., & Shiel, J. J. (2017). Ventilation strategies for a warming world. *Architectural Science Review, 60*(3), 249–254. https://doi.org/10.1080/00038628.2016.1276455

Błażejczyk, K., Kuchcik, M., Błażejczyk, A., Milewski, P., & Szmyd, J. (2014). Assessment of urban thermal stress by UTCI – Experimental and modelling studies: An example from Poland. *DIE ERDE – Journal of the Geographical Society of Berlin, 145*(1–2), 16–33. https://doi.org/10.12854/erde-145-2

Du, Y., & Mak, C. M. (2018). Improving pedestrian level low wind velocity environment in high-density cities: A general framework and case study. *Sustainable Cities and Society, 42*, 314–324. https://doi.org/10.1016/j.scs.2018.07.010

Elsayed, I. S. (2012). A study on the urban heat island of the city of Kuala Lumpur, Malaysia. *Journal of King Abdulaziz University, 23*(2), 121.

Fanger, P. O. (1970). *Thermal comfort: Analysis and applications in environmental engineering*. Copenhagen: Danish Technical Press.

Harun, Z., Reda, E., Abdulrazzaq, A., Abbas, A. A., Yusup, Y., & Zaki, S. A. (2020). Urban heat island in the modern tropical Kuala Lumpur: Comparative weight of the different parameters. *Alexandria Engineering Journal, 59*(6), 4475–4489. https://doi.org/10.1016/j.aej.2020.07.039

Littlefair, P. (1998). *Solar shading of buildings*. Garston: Building Research Establishment (BRE).

Qahtan, A. M. (2019). Thermal performance of a double-skin façade exposed to direct solar radiation in the tropical climate of Malaysia: A case study. *Case Studies in Thermal Engineering, 14*, 100419. https://doi.org/10.1016/j.csite.2019.100419

Santamouris, M. (2012). *Advances in Building Energy Research: Volume 1* (Vol. 3). Earthscan. https://doi.org/10.4324/9781849770397

Standards:

ASHRAE. (2019). *ASHRAE Standard 62.1: Ventilation for acceptable indoor air quality*. American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Department of Standards Malaysia. (2007). *Malaysian Standard MS 1525: Code of practice on energy efficiency and use of renewable energy for non-residential buildings*.

Department of Standards Malaysia. (2017). *Malaysian Standard MS 2680: Energy efficiency and use of renewable energy for residential buildings – Code of practice*.

Reflection

1. **What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?**

My graduation project aligns closely with the MAKE studio theme by using computational design tools to develop climate-responsive strategies for high-rise buildings in Malaysia. By simulating and optimizing passive and active design interventions, the project explores how digital methods can improve thermal comfort and reduce energy use in tropical climates. This approach reflects MAKE's focus on innovation through digital production and the development of context-specific systems

2. **What is the relevance of your graduation work in the larger social, professional and scientific framework.**

My graduation work is relevant within the larger social, professional, and scientific framework because it addresses one of the most pressing global challenges: designing sustainably in the face of climate change. By developing and applying a computational design framework to improve thermal comfort and reduce energy use in tropical high-rise housing, the project contributes to the growing demand for climate-responsive and data-informed architecture.

Professionally, I intend to carry this framework into my future practice, using research-based methods to guide design decisions that are grounded not only in aesthetics but also in environmental responsibility. In today's world, where the built environment is a major contributor to resource extraction and emissions, I believe it is crucial for architects to design more consciously. This project represents a first step toward that goal, making full use of the computational tools available to us and demonstrating how technology can support more informed design.