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A / S Architecture and Building Systems

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Design of a simplified Resistor-Capacitor Model

Semester Project

ITA – Architecture and Building Systems
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Abstract

Acknowledgements

I would like to thank PJ for being a really cool guy

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List of Acronyms

AP	Acidification Potential
ASF	Adaptive Solar Facade

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Introduction

1.1 Motivation and Literature Review

paraphrase Buildings are at the heart of society, and have a large impact on global health, economics and the environment. Europeans alone spend on average 90% of their time in buildings [1] whether it be for work, rest or the multitude of activities that exists in modern society. *paraphrase* EU legislation new buildings. Significance for Switzerland. Energy certification of existing buildings. Performative design of new buildings. Predicting the performance of refurbishments to assess return on investment. Two different types of simulation tools.

Resistor Capacitor models as used in building physics. Earliest use, subsequent progress. Use in codes Importance of the stochaistic term

1.2 Problem Statement

Because they inherently correct for imperfections and variations in the building fabric, stochaistic models are particularly useful when models need to be fitted to a building whose actual properties are unknown.
Technologies such as the ASF need robust, accurate models to generate dynamic control inputs in real time.

Simulation of existing buildings for retrofit purposes is time-consuming and not always accurate. An alternative would be a model that uses sensor data to self calibrate

Traditional simulation approach is not good at describing short-time variations, which are important for control applications.

Potential impacts: time savings in design, platform for innovative active integrated systems, more accurate models.

Lack of transparency of source code when wanting to make modifications to test novel building technologies

1.3 Objectives of Research

A simple, robust, real-time model is needed to control increasingly complex building-integrated systems.

model predictive control? - would require real-time weather forecasts

Find the best fitting model to sensor data to avoid running building simulations.

OR: Use sensor data to calibrate adequately accurate model

- Review literature and select appropriate models
- Set up an 1R-1C thermal model for a single zone as a learning exercise
- program 5R-2C thermal models as per ISO codes.
- Investigate options for discrete solvers
- Write good, transferable, open-source code in Python, making the program operable off linux (more reliable)
- Manage inputs
- output data in a useful and transferable format
- Validate the model:
- against physical data, possibly ASF and CP, or from existing datasets
- Against other models (physics based models) of the same building.
- Add complexity:
- Create a graphical interface with a modular R-C model as input
- Set up PID controller for actuators (ASF) - requires model for ASF
- provide occupancy modelling ... (agent based?)
- use computer vision to compute effective window opening factor from photographs of facade and orientation OR just calculate from rhino geometry

1.4 Thesis Outline

Methodology

We did some stuff to solve our problem statement

Results

The results were really cool

Discussion

We had some really cool results

Conclusion

In conclusion, the results were really cool

Appendix

Appendix A: My first appendix

A blind-ended tube connected to the cecum, from which it develops embryologically. The cecum is a pouchlike structure of the colon, located at the junction of the small and the large intestines.

Bibliography

[1] Dan Staniaszek. Renovation strategies of selected eu countries. *BPIE*, 2014.