Prageeth Jayathissa

Assessment of Adaptive Photovoltaic Envelopes

Diss. ETH No. ?

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ASSESSMENT OF ADAPTIVE PHOTOVOLTAIC ENVELOPES

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A dissertation submitted to attain the degree of

DOCTOR OF SCIENCES of ETH ZURICH
(Dr. sc. ETH Zurich)

presented by

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To Someone

ABSTRACT

English abstract here.

ZUSAMMENFASSUNG

Deutsche Zusammenfassung hier.

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I would like to thank . . .

CONTENTS

NOTATION

FREQUENTLY USED SYMBOLS

E	energy
m	rest mass
p	impulse

PHYSICAL CONSTANTS

c	speed of light in vacuum, $c = 299\,792\,458\,\mathrm{m\,s^{-1}}$

(CODATA 2014 [1])

1

INTRODUCTION

- The potential of Adaptive Architecture
  - The CO2 demand of the built environment
  - Ways in which adaptive architecture, combined with BIPV can mitigate these losses
  - Previous Research
  - Introduction to the ASF to be used as a case study throughout the paper

1.1 RESEARCH QUESTIONS

The four questions addressed in this research are

- How can complex architectural components, such as the ASF be designed and constructed?
- How can a photovoltaic envelope be controlled to be adaptive?
- What is the energy saving potential of an adaptive photovoltaic envelope?
- How does the energy saving potential vary for different building types?
- What is the life cycle CO_2 saving potential of an adaptive photovoltaic facade?

1.2 ORGANISATION OF THE THESIS

The remainder of this thesis is composed of three journal papers and one conference paper. Chapter 2 introduces the parametric design environment, which was created for rapid iterative development of the ASF. This chapter also introduces some of the design elements of the ASF. Chapter 3 introduces the model predictive control strategy to allows for adaptive control. This chapter first introduces the simulation methodology, and then discusses the energy saving potential of an ASF system. Chapter 4 takes on the model from Chapter 3 and runs an evaluation on eleven different building use types spanning six construction periods. Chapter 5 then takes the results of the energy simulation methodology and assesses the carbon life cycle cost. Finally Chapter 6 concludes the thesis.

2

PARAMETRIC DESIGN ENVIRONMENT FOR KINETIC PHOTOVOLTAIC ARCHITECTURE

3

OPTIMISING BUILDING NET ENERGY DEMAND WITH DYNAMIC BIPV SHADING

4

SENSITIVITY OF BUILDING PROPERTIES AND USE TYPES FOR THE APPLICATION OF ADAPTIVE PHOTOVOLTAIC SHADING SYSTEMS

5

LIFE CYCLE ASSESSMENT OF DYNAMIC BUILDING INTEGRATED PHOTOVOLTAICS

6

CONCLUSION

Summary here.

A

APPENDIX

Here be dragons.

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CURRICULUM VITAE

PERSONAL DATA

Name	Prageeth Jayathissa
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PUBLICATIONS

Articles in peer-reviewed journals:

. Jayathissa, P., Caranovic, S., Hofer, J., Nagy, Z. & Schlueter, A. Parametric Design Environment for Kinetic Photovoltaic Architecture. *In Production* (2017).

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