

Table of Contents

List of Figures	vii
List of Tables.....	ix
List of Abbreviations.....	ix
Kurzfassung	xi
Abstract	xiii
1 Introduction and Focus of this Research	1
1.1 Motivation for this Research	1
1.2 Problem Description.....	2
1.3 Objective, Differentiation, and Structure of the Thesis.....	3
2 Related State of the Art	5
2.1 General and Integrated Design Support	6
2.1.1 General Design Support	6
2.1.2 Integrated Design Support in Mechanical Engineering and Architecture, Engineering, and Construction.....	7
2.2 Conventional Façades.....	8
2.2.1 Requirements and Construction Designs of Conventional Façades.....	9
2.2.2 Design Methodologies of Conventional Façades.....	10
2.3 Adaptive Façades	11
2.3.1 Defining Adaptive Façades	12
2.3.2 Advantages of Adaptive Façades	14
2.3.3 Challenges in the Work with Adaptive Façades	16
2.3.4 Examples of Successfully Implemented Adaptive Façades.....	19
2.3.5 Comparing Adaptive Façades with Mechanical Engineering Products, Conventional Façades, and Buildings	21
3 Summary and Clarification of the Overall Research Task.....	23
3.1 Identified Research Need	23
3.2 Research Objectives	24
3.3 Research Methodology of this Thesis	27
4 Journal 1: The Lifecycle Framework.....	31
5 Journal 2: Decision Support in the Early Design Phase.....	33
6 Journal 3: The Integrated Design Methodology	35
7 Evaluating the Research Results with Design Workshops.....	37
7.1 Overview of the Research Results.....	37
7.2 Deriving the Evaluation Strategy	38
7.3 Structure and Participants of the Evaluation Design Workshops.....	42
7.4 Module 1: Evaluating the Checklist of AF-specific Characteristics	45

7.4.1 Individual Assessment by the Workshop Participants 46

7.4.2 Measurable Evaluation of the Design Outcomes of the Participants 47

7.5 Module 2: Evaluating the Database of Adaptive Façades..... 48

7.5.1 Individual Assessment by the Workshop Participants 48

7.5.2 Measurable Evaluation of the Design Outcomes of the Participants 49

7.6 Module 3: Evaluating the Integrated Design Methodology 50

7.6.1 Individual Assessment by the Workshop Participants 50

7.6.2 Measurable Evaluation of the Design Outcomes of the Participants 52

7.7 Summary of Evaluation Results and General Feedback from Participants..... 53

7.7.1 Direct Overall Feedback by the Workshop Participants 53

7.7.2 Statistical Analysis and Standard Error of the Tests 54

8 Conclusion, Discussion, and Outlook..... 57

8.1 Summary of Main Findings..... 57

8.2 Discussion of Results and Limitations 58

8.3 Implications for Research and Practice 62

8.4 Outlook 63

Literature 65

9 Appendix..... 79

9.1 Design Workshop for Evaluation 79

9.1.1 Structure of the Design Workshop 79

9.1.2 Derivation of Evaluation Questions 80

9.1.3 Form Sheets for the Design Workshops..... 83

9.1.4 Additional Direct Feedback from Participants..... 86

9.2 Original versions of the published journal articles..... 87