



Ain Shams University  
Faculty of Engineering  
Department of Architecture

## **Interactive Walls as an Approach for Enhancing Thermal Performance in Egypt**

A Thesis Presented in Partial Fulfillment of the Requirements for  
Master of Science Degree in Architecture Engineering

By

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BSc in Architecture 2008 – Ain Shams University

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## Statement

This thesis is submitted to Ain Shams University for the M.Sc. degree in Architecture.

The work included in this thesis was carried out by the researcher at the Department of Architecture, Faculty of Engineering, Ain Shams University, and During the Period from December 2012 to November 2014.

No Part of this thesis has been submitted for a degree of a qualification at any other university or institute.

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## Abstract

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Thermal comfort in spaces is one of the most important aspects that architects aim to achieve during the design process of buildings. The building external walls play a main role in transferring heat to the designed spaces, therefore walls were developed to be interactive that have integration with building services such as HVAC, also to respond to the environment efficiently to achieve thermal comfort and to increase the productivity of building users. This thesis aims at defining a guideline for the thermal performance of interactive walls in Egypt through the use of different strategies of mechanically ventilated double skin facades (transparent walls) and automated shading systems (opaque walls). The research addresses the thermal performance of interactive walls in three different climatic regions in Egypt (Alexandria, Cairo and Aswan).

The thesis consists of two parts and ends with conclusions and recommendations. The first part introduces and classifies the interactive walls according to the factors affecting thermal performance of buildings. Transparent interactive walls is introduced in (Chapter 1) and its classifications according to ventilation mode. Chapter 2 illustrates the opaque interactive walls concepts and configurations, analytical case studies of buildings using transparent and opaque interactive walls to analyze the thermal performance. In The second part of the thesis an office space in three climatic regions in Egypt (Alexandria, Cairo and Aswan) was selected as a reference case and its thermal performance was analyzed (Chapter 3). The effect of using transparent and opaque interactive walls on thermal performance is analyzed through thermal simulations applied on the reference case, results were compared to the reference case results (Chapter 4). Conclusion of the thermal performance of transparent and opaque interactive walls is presented in (chapter 5) to be used as a guideline in Egypt.

The studied reference case were modeled using Integrated Environmental Solutions virtual environment IES-VE ,thermal performance was simulated using Apache Sim engine integrated in IES-VE . Outputs were presented as space air temperature, energy use, predicted mean vote PMV and percentage of dissatisfied people PPD, Analysis was carried out during occupancy time in the peak day in the three climatic regions in Egypt.



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## Contents

<b>Acknowledgments .....</b>	<b>i</b>
<b>Abstract.....</b>	<b>iii</b>
<b>Contents .....</b>	<b>v</b>
<b>List of Figures.....</b>	<b>ix</b>
<b>List of Tables .....</b>	<b>xv</b>
<b>List of Abbreviations.....</b>	<b>xvii</b>
<b>Glossary.....</b>	<b>xix</b>

<b>Introduction .....</b>	<b>1</b>
---------------------------	----------

Overview .....	3
Problem Statement .....	4
Research Objectives .....	4
Research Methodology.....	4
Research Scope and Limitations .....	5
Research Structure .....	5
Previous Academic Research.....	8

<b>1 Chapter One: Interactive Walls.....</b>	<b>11</b>
--	-----------

1.1 Introduction .....	13
1.2 Evolution of Interactive Walls .....	14
1.2.1 Interactive Walls Definition .....	14
1.2.2 Benefits of Using Interactive Walls .....	15
1.2.3 Interactive Walls Classification.....	15
1.3 Transparent Ventilated Double Walls .....	18
1.3.1 Double Skin Façade Definition and concept .....	18
1.3.2 Double Skin Facades Solar Heat Gain Control .....	20
1.3.3 Working Principles of Ventilated Double Skin Facades.....	21
1.3.4 Cooling Season.....	22
1.3.5 Heating Season.....	23
1.3.6 Ventilation Modes of Double Skin Facades .....	24
1.3.7 Double Skin Façade Configurations.....	26

1.4	Analytical Case Studies.....	29
1.4.1	Twofour54° Zone Project   UNStudio.....	30
1.4.2	Abu Dhabi Financial Center   Goettsch Partners.....	34
1.4.3	Cleveland Clinic, Abu Dhabi   HDR Architecture .....	38
1.5	Summary and conclusion .....	40
<b>2</b>	<b>Chapter Two: Opaque Interactive Walls.....</b>	<b>43</b>
2.1	Introduction .....	45
2.2	Automated Shading Systems.....	46
2.2.1	Definition and Concept .....	46
2.2.2	Working Principles of Automated Shading Systems .....	47
2.3	Analytical Case Studies.....	50
2.3.1	El Bahar Towers   Aedas Architects.....	50
2.3.2	Thematic pavilion   Soma ZT GmbH .....	55
2.4	Phase Change Materials (PCM) .....	58
2.4.1	Definition and concept .....	58
2.4.2	Working Principles.....	60
2.5	Analytical Case Studies.....	62
2.5.1	TrekHaus   Robert Hawthorne.....	62
2.6	Dynamic Insulation Walls.....	64
2.6.1	Definition and concept .....	65
2.6.2	Working Principles.....	66
2.6.3	Performance .....	67
2.7	Analytical Case Studies.....	67
2.7.1	Case study: an office space .....	67
2.8	Summary and conclusion .....	69
<b>3</b>	<b>Chapter Three: Energy Modeling Analysis .....</b>	<b>71</b>
3.1	Introduction .....	73
3.2	Climatic Classification of Egypt .....	74
3.2.1	Weather Data Files .....	75
3.3	Climatic Characteristics of the Studied Cities.....	77
3.3.1	Alexandria .....	77

3.3.2	Cairo.....	79
3.3.3	Aswan.....	81
3.4	Energy Modeling and Software Review .....	83
3.4.1	Energy Modeling Software Choice Methodology.....	84
3.4.2	Selected Energy Modeling Software.....	88
3.5	Thermal Simulation Description of the Output.....	89
3.5.1	Air Temperatures.....	89
3.5.2	Energy Use .....	89
3.5.3	Predicted Percentage Dissatisfied (PPD) .....	89
3.5.4	Predicted Mean Vote (PMV).....	89
3.6	Reference Case Specifications .....	90
3.6.1	Reference Case Geometry Description .....	90
3.6.2	Reference Case Construction Materials .....	91
3.6.3	Reference Case Modeling .....	93
3.6.4	Modeling the Complete Building.....	93
3.6.5	Modeling the Unit to Be Thermally Studied .....	93
3.6.6	Assigning building templates .....	94
3.7	Reference Case Simulation Process .....	97
3.8	Thermal Simulation Results .....	99
3.8.1	Stage One: the whole year period results .....	99
3.8.2	Stage Two: Peak day detailed results: .....	113
۳,۹	Summary and Conclusion .....	119

<b>4 Chapter Four: Interactive Walls Thermal Simulation Results.....</b>	<b>121</b>
--	------------

4.1	Introduction. ....	123
4.2	Transparent Walls Simulation Scenario (Double Skin Facades) .....	124
4.3	Double Skin Facades Simulation Results (Strategies 1 & 2) .....	125
4.3.1	ALEXANDRIA. (DSF SIMULATION STRATEGY 1) .....	127
4.3.2	CAIRO. (DSF SIMULATION STRATEGY 1).....	128
4.3.3	ASWAN. (DSF SIMULATION STRATEGY 1).....	129
4.3.4	ALEXANDRIA. (DSF SIMULATION STRATEGY 2) .....	130
4.3.5	CAIRO. (DSF SIMULATION STRATEGY 2).....	131

---

4.3.6	ASWAN. (DSF SIMULATION STRATEGY 2).....	132
4.4	Opaque Walls Simulation Scenario (Automated Shading System) .....	133
4.4.1	ALEXANDRIA. (AUTOMATED SHADING SYSTEM) .....	137
4.4.2	CAIRO. (AUTOMATED SHADING SYSTEM).....	138
4.4.3	ASWAN. (AUTOMATED SHADING SYSTEM).....	139
4.5	Summary and Conclusion .....	141
4.5.1	Double Skin Façade Performance .....	141
4.5.2	Automated Shading System Performance .....	142
<b>5</b>	<b>Chapter Five: Conclusions and Recommendations.....</b>	<b>143</b>
5.1	Conclusions .....	145
5.1.1	Thermal performance guideline for (Alexandria) .....	145
5.1.2	Thermal performance guideline for (Cairo) .....	145
5.1.3	Thermal performance guideline for (Aswan) .....	146
5.2	Recommendations .....	149
5.3	Future Work .....	150
	<b>References .....</b>	<b>151</b>
I.	<i>Books</i> .....	151
II.	<i>Research Papers</i> .....	151
III.	<i>Theses</i> .....	153
IV.	<i>Websites</i> .....	154
V.	<i>Reports</i> .....	155
VI.	<i>Software</i> .....	155

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## List of Figures

### CHAPTER 1

Figure 1-1 Detail at double skin facade. ....	18
Figure 1-2 Double skin façade components. ....	19
Figure 1-4 solar heat gain control through double skin facade. ....	20
Figure 1-3 solar heat gain control through single pane of glass. ....	20
Figure 1-5 Cooling Season using mechanical ventilation scheme (the use of HVAC return air to cool down the cavity). ....	23
Figure 1-6 Cooling season using natural ventilation scheme in DSF. ....	23
Figure 1-7 Heating Season using mechanical ventilation scheme (the use of room warm air to ventilate the cavity). ....	24
Figure 1-8 Heating season in case of sealed cavity scheme in DSF. ....	24
Figure 1-9 Double skin façade configurations according to partitioning of the cavity. ....	26
Figure 1-10 Wall section detail - shaft box system- ....	26
Figure 1-11 Wall section for corridor type DSF. ....	27
Figure 1-12 Perspective view for corridor type DSF. ....	27
Figure 1-13 Elevation and wall section for shaft box type DSF. ....	28
Figure 1-14 Multi-storey configuration type. ....	28
Figure 1-15 Updated world map of the Köppen-Geiger climate classification. Desert climate (BWh, BWk). ....	29
Figure 1-16 Different perspective shots for Twofour54° Zone Project. ....	30
Figure 1-17 3d Detail of the double skin façade. ....	31
Figure 1-18 Cross sectional detail of the double skin façade. ....	32
Figure 1-19 Twofour54° exploded skin structure. ....	33
Figure 1-20 Different perspective shots for Abu Dhabi financial center. ....	35
Figure 1-21 Double skin façade configuration. ....	35
Figure 1-23 Double skin façade configuration. ....	35
Figure 1-23 Double skin façade configuration during the summer and winter. ....	36
Figure 1-24 Solar visualization analysis of Abu Dhabi Financial District using Sun Cast. ....	37
Figure 1-25 Different perspective shots Cleveland clinic. ....	38
Figure 1-26 Double skin façade configuration detail at Cleveland patient tower. ....	39
Figure 1-27 Relation matrix between different categories of double skin facades. ....	41

### CHAPTER 2