

*In the Name of ALLAH the Most Gracious the Most Merciful*

*"There is a paradigm shift from the making of form, to the finding of form."  
Where "computers no longer represents form, it generates it"  
(Kolarevic, 2004)*

## ACKNOWLEDGMENTS

First and foremost, I thank ALLAH, the Glorious and Compassionate, for helping me to accomplish this work.

I thank my role model and mentor my **Professor / Ali Fouad Bakr** for enlightening me through his wide knowledge and his deep intuition and being patient with me to finish this work. Further, I am grateful for the opportunity I was given to learn from his experience. Also I would like to thank **Doctor / Mohamed Nasr** for giving me the opportunity to finish this work.

I am very grateful for all the knowledge I have received throughout these years of my thesis studies. It is a pleasure to thank all those who directly made this thesis possible.

I would like to express my special gratitude to my parents for teaching me to value the pursuit of knowledge since my early childhood. I hope that I can be a role model for my daughter, the same way that my parents were to me. I want to thank my family members who helped me a lot through my educational life; mum, sister, uncle and grandma. Thanks to my helpful, wonderful husband for encouraging me to finish my work. Finally, I would like to honor the memory of my beloved father. May God bless his soul.

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**ABSTRACT**

One of the most persistent challenges which face the theory and practice of architecture today is the paradigmatic shift of computational design process that occurs in design practice as well as the emergence of digital technologies. Virtual and physical evolutionary form finding process has evolved in research. It has shown some development and it has been progressive throughout the previous decade. Bound with algorithms, genetics, bio-digitals and other new forms, architecture is regarded as the succession of different radical evolutionary styles. It transformed the shape of buildings, the way it is formed and the birth of design extremism is rapidly increasing; however, it's the era of generating form especially through evolutionary design and morphogenetic computational tools more shapes of buildings are being experimented. Thus, it is a clear indication that paradigmatic shift of design process is reshaping the way architects perceive and design buildings.

The new mode of designing buildings in today's digital age is evolutionary architecture. The key concept behind evolutionary architecture is the use of morphogenetic computational process as a class of highly parallel evolutionary, adaptive search from biology. It proposes an evolutionary model of nature as the generating process for architectural form. In this approach, architectural morphology is expressed as generative rules so that evolution and transformation can be accelerated and iterated by the use of computer and physical models. As computational tools are becoming powerful, evolutionary design process have widespread in research. It is now used in practice and finding of form instead of making it and popularly known as Emergence.

The Theory of Evolution Emergence looks up at any natural phenomena like genetic space from biology and extracts their morphogenetic process and morphological formations as a generator of design. Several applications of this theory are Morpho-Ecologies, Bio thing and Continuum, genetic algorithmic and L-System in Architecture in which a morphogenetic process is applied as form generator to architectural design. Nevertheless, its approach takes up from biological computational and evolutionary morphogenesis for which the process of evolutionary development and growth of organism is observed and applied as generative morphogenetic process so as to model building forms.

In the process of engaging with the evolutionary design methodologies, this thesis discusses a novel approach of conceptualizing building approaches in the nowadays stage of digital design. The paper discusses the background of evolutionary architecture and elaborates on the topic by discussing theoretical aspects of evolutionary form generation and the digital tools technologies behind the design process.

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# ACRONYMS AND ABBERRIATIONS

- **2D** Two dimension (Two dimensional representations of geometric models)
- **3D** Three dimension (Three dimensional representations of geometric models)
- **AI** Artificial Intelligence
- **AIA** The American Institute of Architects is a professional organization for architects in the United States.
- **AL**
- **BIM** Building Information Modeling is the process of generating and managing building data during its life cycle. Typically it uses three-dimensional, real-time, dynamic building modeling software to increase productivity in building design and construction. The process produces the Building Information Model also abbreviated BIM.
- **Blob** The word blob describes the computer generated structures through the virtual environments, blobs are considered metaphorically synonymous with isomorphic poly surfaces.
- **CA** Cellular Automata
- **CAAD** Computer aided architectural design.
- **CAD** Computer aided design; it is about the use of computer technology of the design of object.
- **CAM** Computer aided manufacturing.
- **CNC** Computer numerically controlled fabrication.
- **CO<sub>2</sub>** Carbon dioxide is a chemical formula.
- **DWG** A file format used for 2 and 3 dimensional design data.
- **EA** Evolutionary algorithm
- **EC** Evolutionary computation
- **GA** Genetic algorithms
- **GC** Generative Components
- **NURBS** Non-Uniform Rational B-Sp lines
- **Water-jet** A water jet cutter is a tool capable of slicing into metal or other materials using a jet of water at high velocity and pressure.
- **GADO** Genetic Algorithm for Design Optimization
- **GS** Generative System
- **GADES** Genetic Algorithm Designer Evolutionary Systems
- **EDGE** Evolutionary Design based on Genetic Evolution system
- **EMC** Evolutionary Morphogenetic Computation
- **Para Gen** Parametric Genetic Algorithm
- **FEA** Finite Element Analysis
- **Geco** Generative modeling Energy Correlating Optimization

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**CHAPTER 1.**  
**INTRODUCTION**

*In this preface, the research presents an overview of the thesis, introductory to the research, the core of the research problems and question, the aims and objectives, and the research methodology.*

# CHAPTER ONE

## INTRODUCTION

**CHAPTER STRUCTURE:**

