

Quantum potential energy: Adaptive facades in architecture

Batool Mowafaq Kadhim¹, Abdulla S. AL-Maamory¹, Ahmed M. AL-Ghaban²

¹ Department of Architecture, College of Engineering, University of Technology, Iraq

² Presidency of University of Technology, Iraq

*Corresponding author E-mail: eng.batool7@gmail.com

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Abstract

This paper addressed the topic of creating quantum architecture through human awareness to transform the formal and spatial elements of architecture according to its environmental sustainability compatible with nature. The research emphasizes the creation of a built environment that uses natural resources to enhance the psychological and physical comfort of humans, relying on the quantum energy inherent in the interaction of particles, which is called “kinetic energy” in quantum mechanics, and it can be considered energy due to motion.

The research aims to determine the recommended standards for use in designing the building facade according to the magnetic field lines. It focuses on the classification of smart interfaces in particular. The complexity of evaluating adaptive or dynamic facades is related to evaluating the performance of the facade elements and systems, the overall performance of the building, as well as the behavior and satisfaction of the occupants.

The research seeks to present a conceptual and cognitive framework by linking the concept of potential kinetic energy and quantum theory with architecture and then presents a group of literary studies that will enrich and build the theoretical framework and then apply it to the groups of projects selected for practical study and then reach the final conclusions.

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1. Introduction

The rapid development of the technical and intellectual revolution is in a direct relationship with the development of human perception and all sciences, as this development led to tools and devices capable of measuring all changes emanating from influences outside the limits of sensory perception (perception through the five senses). From an architectural standpoint, the idea of mutual influence between the building and its user is brought to new dimensions that are not limited only to the limits of human perception, but also to the energetic impact of the space used. An example of the presence of influences (waves) outside the limits of perception is the presence of an electromagnetic energy field of high intensity and of a certain frequency (high-frequency energy field) that penetrates a space designated for sleep or rest, leading to a state of tension, anxiety, or insomnia at the energy level of the user of the space. It raises the frequencies of the aura energy surrounding it,

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causing it to be negatively affected, and this effect of the electromagnetic wave energy was present even though it was not felt through the five senses [1, 2]. With the development of laws and theories that deal with quantum physics, it has become possible to benefit from unconscious and interacting energy influences to reach conscious awareness through two types of energy [3-6]:

1. The energy transmitted by any particle present in this universe (the particles that make up the user).
2. Electromagnetic energy fields in architectural spaces emanating from the interior of the Earth or the materials that make up the space itself.

To study these energy extensions in terms of their impact on the user and his ability to perceive them and their effect on energy behavior within space. From the above, one of the most important goals of integrating quantum physics and architecture from an architectural perspective is to reach quantum architecture that results from design according to a system of design elements that take into account the unperceived energy impact of the material in order to reach an aware awareness of the electromagnetic waves (energy) resulting from binary behavior. For the particles present on the surface of Earth, according to what is stipulated in the quantum physical theory, have been scientifically proven over the years and used in many fields, there is a significant effect of the waves emanating from man or space. It affects in raising or lowering the level of the user's energy frequencies and the place. This is a continuous interactive relationship as extensions of a single essence with a flowing movement towards internal and external reflections to achieve stability and enhance these energies to improve the functional performance of the user and the space with a mutual influence and effect relationship, as a state of extension and crossing of the mind towards a conscious awareness of the essence of the energy that makes up that space.

2. Quantum concept

2.1. Definition of quantum

In linguistic terms, quantum is a quantity of something. Hence, the expression "quantum mechanics" means the study of the movement of quanta. Nature seems to happen in spurts; quanta and quantum mechanics observe and study this phenomenon. Quantum theory began its journey in 1900 when Max Planck proposed the idea that electromagnetic radiation emerges in the form of strings, or quanta, which we today call photons. The photon can be considered, in a sense, a particle of light. This idea is difficult to reconcile with the old assumption that light and other electromagnetic radiation consist of waves.

The term quantum did not appear for the first time as a theory, but rather as a principle, in the year 1900 with Max Planck (1858-1948), and its features as a theory were not completed until the 1940s of the last century, when matrix mechanics was formulated with Niels Bohr (1885-1962) and wave dynamics with Irving Schrödinger (1887-1961).

Every possible quantity of energy that particles can exchange is referred to as "quantum" in the physical world. It denotes discrete, non-constant amounts of energy that are released at regular intervals. When talking about quantum mechanics, the words "quantum physics" and "quantum theory" are often interchangeable. Referring to relativistic quantum mechanics, some writers use the term "quantum mechanics" to describe the field that encompasses both classical and relativistic theories of motion and gravity, as well as optics, thermodynamics, statistical mechanics, and the laws of radiation [6-9].

2.2. Cognitive interpretation of quantum mechanics

This kind of nebulous, grey line between the mental and physical realms is present in the foundations of all great and minor philosophical and religious traditions. The third principle that underpins both the mind and the universe is interrelated and more basic in the vast majority of circumstances. Animals and humans are inseparable parts of the natural world. Actually, the Greek term physics, meaning "nature", is where the English word physics comes from. The idea that man is intrinsically related to and a part of the cosmos predates the widespread belief in a strict dichotomy between mental processes and physical reality [4]. The problem with

this, and with the advent of quantum mechanics in general, is that our perception and understanding of the world are primarily controlled by observables and by a mind/body complex that is hardwired to perceive and comprehend things.

In order to understand how a notion, idea, or thought becomes a material reality—or more precisely, how the mind shapes this material reality, we must delve into the link between the mind and matter and the ways in which these two realms intersect and interact. Among many other areas, psychology stands to benefit the most from a better grasp of the connection between the mental and physical realms. The creation of a framework for defining the nature of the connection between mental processes and physical objects, as described in the literature of cognitive science, with regard to the relationship between form and substance, or thoughts and conceptions.

The fundamental building blocks of any system are ideas, or more precisely, the idea of an idea. An idea is a cognitive entity that has certain characteristics and is believed to have connections to other, more objective events. Here, the word "idea" is analogous to Plato's "form," but the concept has since broadened to encompass not just "form" but also "a group of forms that have relationships with each other" [5, 10-12].

2.3. Principles of quantum mechanics

General theories are the basis of quantum mechanics. All things, from subatomic particles to galaxies, are thought to be subject to it. The most interesting aspects of quantum mechanics, however, fall into three categories: complementarity, uncertainty, and entanglement. Drawing parallels between the groundbreaking experiments that sparked discoveries and the technological marvels of today is an intriguing exercise.

1. Working in tandem: When Niels Bohr first proposed the idea of complementarity in 1928, he essentially said, "In the case where the wave side of a system is revealed, the particle side is hidden; in the case where the particle side is exposed, its wave side is hidden." This was a significant contribution to the field of quantum mechanics. Since wave and particle properties are mutually supportive, it is physically impossible to detect them at the same time. In other words, according to quantum physics theories, there is no mathematically permissible quantum state that can represent the information provided by experiments that, in theory, cannot be conducted simultaneously owing to the physical properties of the gadget needed, and the pieces of information that can be gleaned from incompatible measurements are fundamental pieces of information. In light of the foregoing, it follows that the wave nature of matter must be concealed while its particle nature is being revealed or measured, and the reverse is also true. The complementarity principle states that it is not possible to see both the wave and particle properties of matter at the same time [3, 13-15].

2. The second phenomenon is quantum entanglement. It occurs when two or more particles are coupled in a manner that their states are dependent on one other, irrespective of the distance between them. It follows that the state of one entangled particle can be used to quickly ascertain the condition of its partner, regardless of how far apart they may be in the physical universe, even if they are light years apart. The speed of information transmission, which should not surpass the speed of light according to Einstein's theory of relativity, seems to be challenged by this instantaneous action at a distance. This phenomenon deeply troubled Einstein, who memorably called it "spooky action at a distance." Although quantum entanglement has been confirmed experimentally multiple times, a thorough comprehension of its consequences and possible uses (such as quantum computing and quantum teleportation) remains an open question.

3. Lack of clarity: It is widely recognized as a crucial formula of quantum theory and a cornerstone of contemporary physics. German physicist Werner Heisenberg proposed it in 1927 AD; he arrived at it by calculating the foundations of matrix mechanics, which represents the quantum formula of quantum theory; Schrödinger's wave mechanics, which represents the wave formulation of quantum theory; and Paul Dirac's unification of the two systems, which is considered elementary quantum theory. "It is not possible to determine two measured properties of a quantum system except within certain limits of accuracy," says this principle, which means that measuring one property extremely accurately (with small uncertainty) results in measuring

the other property with great uncertainty. A human can never have complete and accurate knowledge, according to this idea. He may not be able to quantify every detail, but there is still a great deal he doesn't know [16].

4. The concept of locality which originates in Eisenstein's theory of relativity, asserts that physical processes taking place in one location should not instantly impact aspects of reality in another location. Multiple tests have shown that this theory is false. New ideas for a multi-dimensional cosmos emerge from violations of the locality principle; these ideas mature into many-world interpretations and superstring theory, two of the most influential frameworks for making sense of quantum reality.

5. Dualism: The idea that all energy and matter have both wave-like and particle-like characteristics is called wave-particle duality. The lack of a complete description of the behavior of small-scale objects by classical notions like "particle" and "wave" is addressed by the key idea of duality in quantum mechanics. There will always be tension between the present reasonable idea and some potential future state of the system because it is hard to know with certainty what the designer will decide; to save the designer the trouble of trying to represent an unrealistically simplistic method of decision-making.

2.4. Ketogenic potential

One of the two types of energy is potential energy, which is the energy that an item stores when it is at rest. The second kind is kinetic energy, which is the amount of energy a moving body exhibits. Where an object is in relation to other objects determines its potential energy. The potential energy of a brick, for instance, is greater when it is suspended from a two-story building as opposed to when it is set on the ground. Potential energy, according to a small group of natural philosophers in the late 19th and early 20th centuries, is best represented by kinetic energy because, although its shape is amenable to observation, its essence is motion. One benefit of this view—that all potential energy is really kinetic—is that it maintains the idea that the physical sciences seek to explain the world around us through the characteristics of matter's motion. Doing so yields a full physical explanation for any occurrence. When we see these changes as shifts in the system's potential energy, however, things change. Potential energy isn't explicable; at its core, it's just a way to formalize the findings of experiments.

Official adoption of the notion of indeterminism occurred in 1925. Although it may seem like an epistemological principle at first glance, Heisenberg's principle is actually an ontological one; it states that physical indeterminism cannot be verified and that it is impossible to measure and determine the position and speed of the quantum part at the same time. The strength of this principle is in the exact mathematical language it uses to express physical indeterminism. A further remarkable phenomenon that emerges as a result of the principle of indeterminacy is the concept of "passing through a quantum tunnel." The following principle is commonly used when dealing with the position and velocity of elementary particles: "Two measured properties of a quantum system can only be determined within certain limits of accuracy". In other words, if one of the properties can be determined with extreme precision (with small uncertainty), then measuring the other property with great uncertainty is also possible. A human can never have complete and accurate knowledge, according to this idea. Even if they tried, they still wouldn't be able to quantify everything with absolute certainty [16, 17].

We derive the conclusion that one cannot reliably determine the location and momentum of an object at the same time. Because matter is both waves and particles and because atoms and subatomic particles have such tiny masses, the uncertainty surrounding their velocities will grow in proportion to the precision of their positions.

One of the acknowledged issues with potential energy is the difficulty of localizing it, or splitting it into particular areas of space. This is based on the premise that physical processes must be thought of as taking place within space and time. One possible way to look at potential energy is as a field of "visible" coordinates representing the kinetic energy of "hidden" motions whose character cannot be completely known, maybe because of their complexity or because we don't have all the necessary knowledge. If we are unaware that there are movements in it, a system without potential energy would appear to have it, as Webster in 1904 pointed out.

Kinetic energy is the result of the motion of matter, which could be inside or outside the system. The forces that exist between the visible components of matter can be explained by viewing potential energy as the visible result of invisible processes. While Roth's suggestion does provide a different way of looking at potential energy as a way to get around subtle motion, it does so by rephrasing variational theory and introducing a minor new view. For instance, it doesn't appear to aid in resolving the issue of potential energy localization.

Regardless of this limitation, there is a branch of physics where it would be fascinating to try to implement these concepts. The system of quantum mechanics can be described as a process where the kinetic energy factor is related to both kinetic and potential energy, as is well known. An interpretation of quantum mechanics grounded solely on physical reality, particles, is aided by three significant historical ideas in the study of motion: ontology, particles, and the rejection of the continuous classical motion in favor of the intermittent quantum motion.

2.5. Quantum architecture

The mind is the architect of quantum systems. The core tenet of quantum mechanical theory as it pertains to building design is the idea that design is an intentional process of arranging and altering formal and spatial aspects in accordance with their inherent harmonic sustainability. When a quantitative relationship occurs in architecture, two or more activities harmoniously engaged in a changing relationship with each other and with the context that affects them, their separate roles will act jointly, thus becoming cooperating individuals. In terms of quantum mechanical theory, it is not possible to determine where one role or activity ends and the next begins. This “line” will have harmonic oscillations back and forth from one to the other, to maintain their cooperative mission.

As the quantitative system in architecture is interpreted as the presence of consciousness - awareness of the environment and its conditions, in order for a building to achieve immortality, it must respond harmoniously to those external influences that affect or will act on its built environment. Since quantum construction seeks to exist in a cooperative relationship with the forces of the natural world, and because the quantum world is incapable of determination, quantum construction will not attempt to define or change the world. To do this, the building will be able to “stand on its own” without assistance and will have the ultimate power to dictate the future state of an “automated” world.

Quantum aesthetics are expressions of architectural reason and utility. They are communications between a building and its user that demonstrate an appreciative dialogue, as the quantum building declares its purpose and function, and the quantum user sees, accepts, and enjoys the building for what it is. When a building succeeds in promoting positive human consciousness, it is in a give-and-take dialogue with its external, contextual influences. Contextual influences are humans and environmental conditions – both of which influence and are affected by the existence of a building.

Contemporary physics does not specify a single metaphor to explain quantum reality but describes reality in terms of quantum properties. These characteristics are described as follows:

1. The world is not a specific mechanism.
2. Quantum theory is characterized by the fact that it describes the characteristics of an observed entity differently from an unobserved entity.
3. Observed entities, such as buildings, exist interconnectedly with external influences.

Reality is created by human consciousness, to generate potential and actual design responses. During the architectural design process, relationships, timelessness, and aesthetics are developed as architectural issues. Any architecture we envision must be created in a conscious response, and this architecture is judged as good or bad by its success in combining functional and/or human needs.

When two activities have direct and influential relationships with each other, they should be seen as working together as a team. A quantum facility will connect its related activities through physical continuity. This will encourage interaction and participation among users. The quantum building will also connect its residents to

nature and the outdoors. By giving employees the opportunity to experience the magnificence of the view, landscapes, and natural places, they will have a positive incentive to devote their attention to their study of nature and its energy.

Within the architectural composition, each function and element will act as a contributing force to the project's overall mission to provide for human needs. The quantum building will enable itself to remain as it was meant to be, by responding to the nature of gravity, wind, rain, earth, and sun. The quantum facility will use the natural energies of solar radiation and natural architectural materials. It only makes sense to employ energy and friendly, exploitative natural elements in efforts to resist the destructive forces of raw nature.

In order for architectural identity to take place, in the fields of quantum mechanics theory, the origin of the past and the needs of the present must be transformed to the extent that they overlap, and in doing so, the formed building creatively gives new life and meaning to its origin, and creatively positions itself for the future. The building will want to recognize what it was in the past and what it intends to do in the future.

3. Literature survey

In [11], the research is based on studying the morphological approach to biomimetics, and parametric daylight simulation to develop a multi-layer biomimetic kinetic interface shape, inspired by the morphology of trees to improve daylight performance for the user. To explore how biomimicry affects the functions of the kinetic interface, the study applied the biomimetic morphological approach to derive tree morphological strategies due to dynamic daylighting. In terms of functional convergence, the principles of biomimetics were translated into the shape and movements of the kinetic interface. The extracted shapes and motions are translated into kinematic interface design solutions resulting in the flexible shape using cross- and multi-layer shells and kinematic vectors with bending motions.

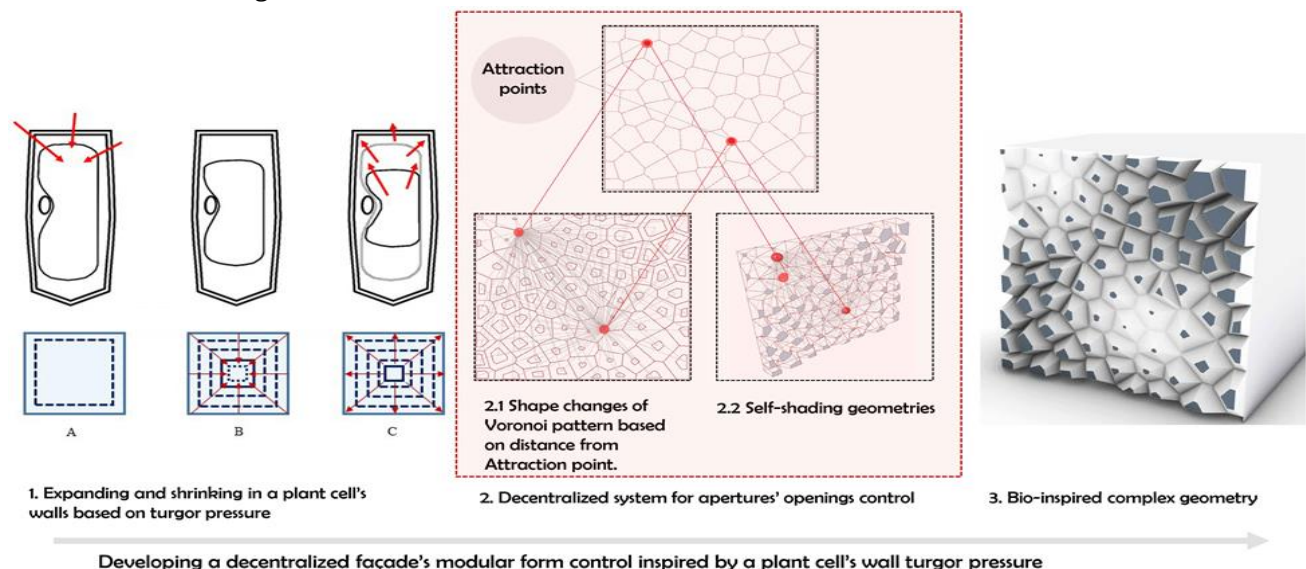


Figure 1. Development of a modular control of the eccentric interface inspired by the pressure of plant cell wall distension

A possibility to attain a tuneable configuration that transitions from the stationary to the kinetic phase arises when design rules are adopted from biological systems. Using the morphological method of biomimetics, this study investigated biometrics (the morphology of trees) [12]. When we think about the practical relationship between trees and buildings in terms of visual comfort and daylight, we see that trees serve to filter, enlighten, and harness sunshine in a variety of ways, including transmission, redirection, dispersion, and interception. As a result, trees can be usefully explored, and morphological similarities discovered through daylight-induced hierarchical functional convergence.

In [13], buildings are no longer static musical parts; they may now move, spin, flip, and execute other physical motions, leading the study to suggest the tectonics of kinetic architecture, moving structure, and shifting space. Looking at kinetic buildings through the lens of tectonic theory, this study intends to investigate their technical, aesthetic, and spatial features. Tectonics and the actual movement of building components are the main points of emphasis. According to the findings, the nature of the movement and the function of the moving parts alter the tectonic character and architectural space of the structure. The existential nature of the structure is altered by some motions and moving components, while others are directly associated with representational elements.

This research aims to shed light on the theory of tectonics by tracking the development of structural adaption requirements. The already-called-kinetic behavior of such a building type defies easy explanation in terms of function but can be understood as evidence of technical advancement. Designed to shift and move in commemoration of transience, these buildings differ from everlasting, ever-changing historical monuments. Kinetic architecture refers to structures or parts that can be manipulated mechanically, chemically, magnetically, or pneumatically, or that can fold, slide, or expand. Despite the conventional wisdom that architecture is immobile, kinetic architects embrace motion as an integral part of their designs. Longevity, improved function, user experience, ease of use of new technologies, affordability, and environmental friendliness are some of the many potential benefits of this design style [14].

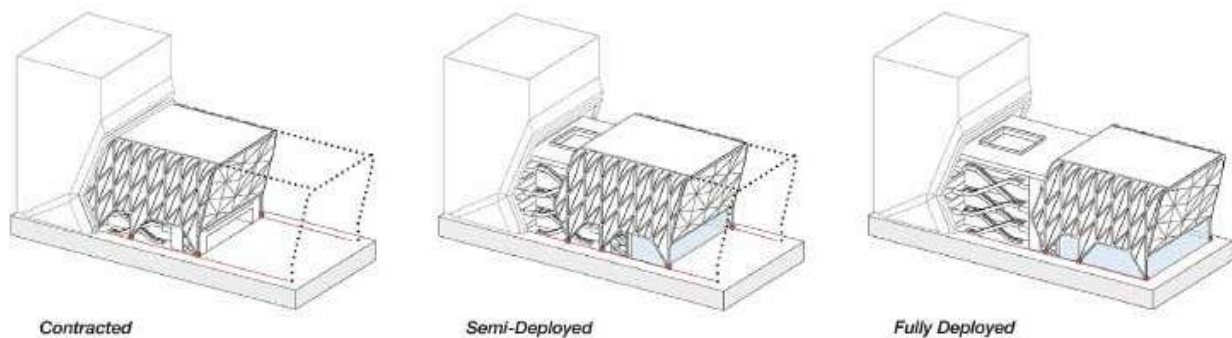


Figure 2. Moving cover

Based on the study's findings, the physical shape of a building cannot offer a linear cover for the constantly shifting set of stresses, making the link between the two variables unstable. In order for the original set of requirements to grow, alter, and progress, architecture, like organic shape, must be adaptable. In addition to interacting with people, the built components also communicate with one another. To put it another way, with this kind of interaction, the user controls the building's or component's reaction to changing conditions, and vice versa.

In [18], we find that the kinetic energy of extra "hidden" freedoms is equal to the quantum potential energy of particle interaction, which stands for quantum effects, by utilizing Roth's non-negligible coordinate technique. The Planck constant, a hidden variable in this setting, can be seen in a new light by using this method. We call the study's model a "proof of concept" because of how novel it is. The Planck constant and the density-dependent component of hidden kinetic energy remain unexplained, even after redefining the hidden initial speed in a comparable fashion. The hidden variables may not represent a real-world system at all, but rather higher-dimensional spatial coordinates or degrees of freedom, such as rotation. The theory is applicable to the Kaluza-Klein program. Regardless of the conceptualization, subtle motion is interesting because it has a density that differs from the quantum expression (probabilistic) expression, but a continuity equation that is comparable to quantum flow. It is known that potential energy is difficult to localize or divide into distinct spatial zones due to the fact that all physical processes occur within the framework of space and time. The kinetic energy of "hidden" movements, the nature of which cannot be known in full detail in the "visible" coordinate field, can be expressed, according to some, by looking at potential energy. All matter, whether inside or external to the system, is capable of generating kinetic energy.

4. Adaptive interfaces in quantum architecture

Adaptive facades are building envelopes that can adapt to changing climate conditions on an hourly, daily, seasonal, or annual basis. The word “adaptation” here means the ability to interact or take advantage of external climatic conditions to meet productivity and mainly to successfully achieve the comfort and well-being of the occupant [7].

Loonen defined them as multi-purpose, high-performance envelopes that respond mechanically or chemically to external climatic dynamics, unlike fixed curtain walls, to meet the requirements of internal loads (cooling, heating, lighting, or ventilation) and user needs [10]. Adaptive facades can provide incremental upgrades in energy efficiency and use of renewable energy while improving building comfort for users [9]. It refers to the use of magnetic materials or magnetic properties in the design of building facades in ways that help regulate the amount of light and heat that enters the building. This technology allows the transparency and reflectivity of magnetic materials to be adjusted by applying an electric current to them, allowing control of the amount of solar light emitted and reducing the need for heating, cooling, and lighting systems.

5. Results and discussion

The effect of the magnetic field on comfort areas in buildings has been studied. Because there are different types of buildings and different methods of use, appropriate studies are required for each type and ground magnetic effects must be distinguished from magnetism caused by electrical energy in the building. It is clear from all of the above, there is a broad definitional scope of the concept of energy in various areas of life, including architecture. However, in general, it is related to nature, the ability to cause action, as well as the nature of its existence (latent or kinetic), and in multiple forms, whether natural or artificial energy.

5.1. Sharifi house

Designing Sharifi-ha House was based on the idea of uncertainty and flexibility. Changing the arrangement of circulation boxes causes the building's volume to become more open or closed, taking on an introverted or extroverted personality, which in turn affects the interior's dramatic and spatial aspects and the exterior's formal composition. Seasonal variations or different floor layout functioning conditions may trigger these modifications.



Figure 3. The open/closed volume of the building serves as a reference to traditional Iranian houses, which would serve as dynamic seasonal patterns of housing

In the living area, dynamic features play a far different role; the master bedroom resembles a staircase and, when it slides out of the building, becomes an outdoor bedroom, a balcony, because of its unique form. Similarly, the total area of the balconies and open spaces in the Sharifi apartment is changed when the kinetic

boxes in her residence move, in addition to the spatial arrangement within the apartments. In some cases, the host buildings undergo fundamental alterations as a result of the transfer.

Traditional Iranian houses, with their open/closed building volumes, would serve as household patterns that changed with the seasons, with winter living rooms and summer living rooms added to different sections of the house. There are seven stories to the house; the first two are devoted to the parking and housekeeping areas, and the bottom two to family living, wellness areas, and workout facilities. The first two floors are used for public events, while the third and fourth floors are reserved for the family's private lives.

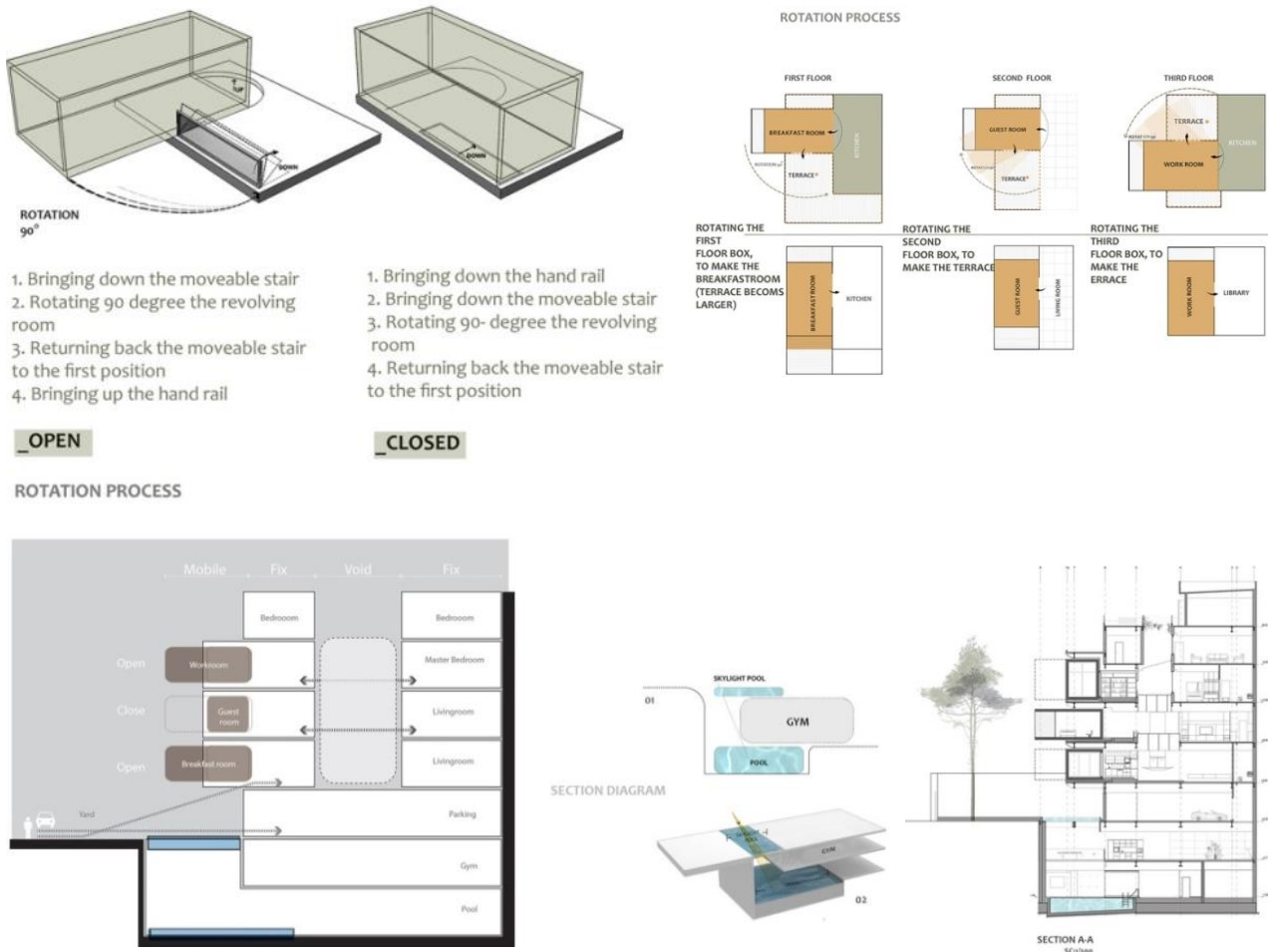


Figure 4. The house adapts to the functional needs of its residents

The design of the circulation boxes took handrail features and techniques for regulating air penetration into account. A couple of options for fixing the problem were making the railings foldable and making the boxes' edges better. It was a tailor-made structural structure. Following the structure's numerical modeling, a battery of SAP2000 analyses was run to evaluate the proposed system's static and dynamic performance. All of the primary weight is concentrated on the living room beams, making their partially moveable nature the defining characteristic of this structural assembly.

Because recycling bins come in a variety of shapes and sizes, the load calculation was based on the maximum load that could be applied to the system. Also considered during design and calculations was the possibility of structural distortion due to vibration control in the spinning boxes.



Figure 5. The interface is narrow, so converting the 2D interface into a 3D interface is indispensable

A 150-meter-tall twin tower with a solar screen that moves in response to the sun's rays and a design inspired by beehives. By automatically adjusting to the sun's angle, these solar screens let more natural light into a structure while reducing energy use, radiation, and glare. The structure is comprised of a pair of 150-meter-tall circular towers that are encased in a curtain wall that is adorned with a kinetic shading system. Offices and a service center are located on the top floor of the skyscraper.

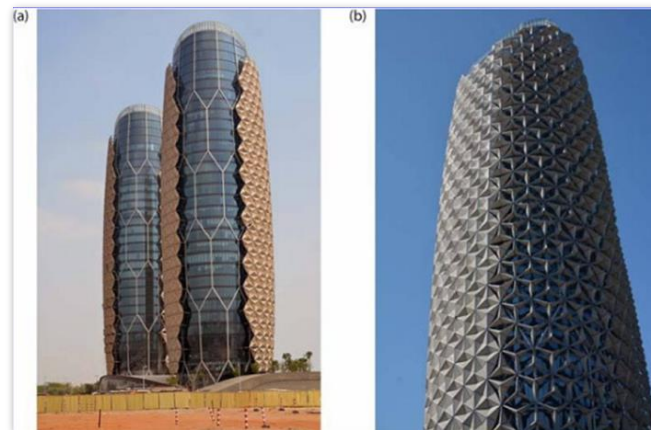


Figure 6. (a) North facade and (b) South facade of Al Bahr Towers, with some open and closed shading devices - coordinates: 248 27' 23"N, 548 24' 4"E

Triangular modules resembling origami umbrellas form the screen of the dynamic shading system. In order to prevent direct solar radiation, the triangle units unfurl at varying angles in response to the sun's movement [8].

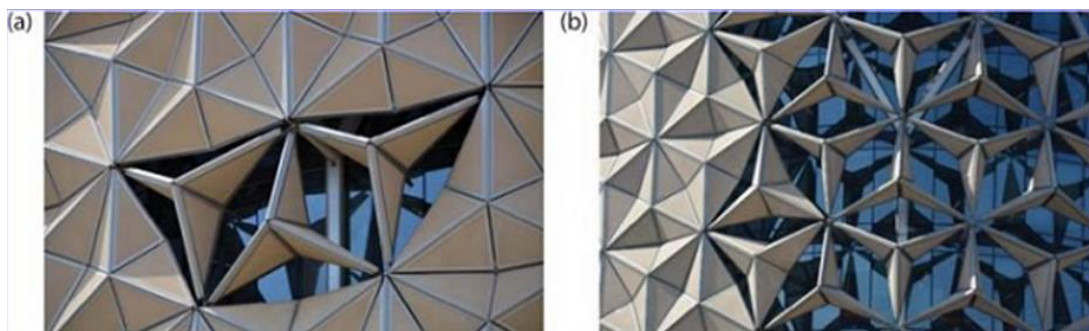


Figure 7. (a) Three fully open shading devices allowing open viewing during non-solar periods and (b) A set of fully open shading devices

A combination of Islamic *mashrabiya* (hexagonal shape) and the shading system of opening and closing flowers in response to weather variations inspired the building's design. There are two facades to the structure; a glass wall makes up the inner facade, which is two meters away from the exterior. The external facade is made up of 2000 umbrella-like units, with 1000 units each tower. These units automatically respond to direct sunlight, which reduces the building's energy usage and is regarded a 50% heat savings.

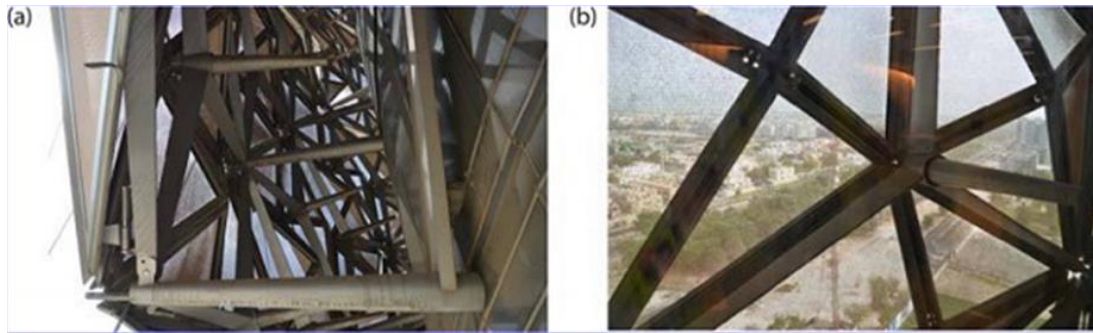


Figure. (a) Close-up view of the *mashrabiya* and curtain wall where the support sleeves penetrate the curtain wall and connect to the main structure and (b) External view when the *mashrabiya* is open

Microstrip filters, amplifiers, antennas, and diplexers can be engaged to enhance quantum potential energy in recent buildings [19-26].

6. Conclusions

1. It is important to note that while magnetic architecture has the potential to provide innovative solutions, its practical implementation may vary depending on technological developments, cost-effectiveness, and regulatory considerations. The field of magnetic architecture is still evolving, and future discoveries and developments in materials science and engineering are likely to expand its possibilities.
2. Using magnetic materials in adaptive building facades to control the amount of light and heat entering the building. By applying an electric current to magnetic materials, their transparency and reflectivity can be adjusted, regulating the amount of sunlight and reducing the need for heating, cooling, and lighting systems.
3. Using magnetic materials to capture and convert wasted energy into usable electricity. Vibrations or movements in the environment can be converted into electrical energy using devices such as magnetic generators or electromagnetic induction systems.
4. The structural system in this type of architecture is an ad hoc system, being partially movable is the dominant feature of this structural assembly.

Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

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Author contribution

Batool Mowafaq Kadhim: Conceptualization, Methodology, Review & editing, Formal analysis and investigation, Writing, and Editing.

Abdulla S. AL_Maamory and Ahmed M. AL_ghaban: Review and Supervision.

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