

(RESEARCH ARTICLE)



The design of residential spaces between Form transformation and dynamic movement for interior kinetic furniture

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Abstract

Morphological and kinetic transformations are the main sources that give the shape an impetus for the development of new design techniques.

Harmony of the interior spaces with their surroundings can be achieved by adopting innovative methods based on modern technologies and new construction materials.

The shift from harmony to interaction can be defined through the use of smart materials that make the building interact with the surrounding environment. This is crucial to know the relationship between movement and architectural design, which results in several auxiliary studies such as the following examples:

- Studying the evolution of the programmed movement concepts in interior architecture.
- Studying and monitoring the various types of movement in the architectural forms and their impact on the formal transformation in the internal architectural composition.
- Studying and monitoring the methods of achieving movement and dynamism in the formulation and composition of the internal architectural work.

The problem of the study lies in the lack of knowledge of scientific foundations to achieve integration between the vocabulary of techniques, digital technology, artificial intelligence, programming, and the traditional architectural space.

Accordingly, the study lays out the basics that must be available in the kinetic design ideas, and presents analytical models of design concepts and treatments, as a result of what information technology has provided capabilities that did not exist before.

Keywords: Modeling; Kinetic; Digital Technology; Dynamic; Interactive

1 Introduction

Bases and Elements of Designing Interior Dynamism Spaces Through studying the following elements:

- Concept of Dynamism in Interior Architecture:

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Discussing the most important dynamic theories in interior design, the most important pioneers – as it depends on dynamism, reaction, and conflict with all movements, events, work, and acts . These concepts refer to dynamism, substantial, moral and symbolic motion such as illustrations motion, conversion, and harmony.

The transformation process can be defined as the structural process that deals with the plastic structure - planar or spatial - with features of self-completion so that its shape is transformed into another form with different self-completion features. This happens through moving the basic determinants of formation, such as vertices and sides so that it takes new positions with the formed body while maintaining the same size of the structure before and after the transformation process.

Accordingly, the study lays out the basics that should be available in the kinetic design concept. It presents analytical models of design ideas and treatments, as a result of what information technology has provided capabilities that did not exist before. The concept and shape of the interior spaces will change according to these capabilities.

2 The Main Concepts

We conclude that dynamism concept is defined through conversion, change, transference, rotational deviation, scale and reflection according to the above, formal characteristics express type of material or technique used in forms production, as formation represents types of used technique and may express construction method, accordingly it depends on technological capacities which transfer ideas to physical material and conveys meaning to others, also technology methods satisfies functional, pragmatic, aesthetic and environmental requirements through for and according to order of building elements it determines, accordingly ,the technique creates form

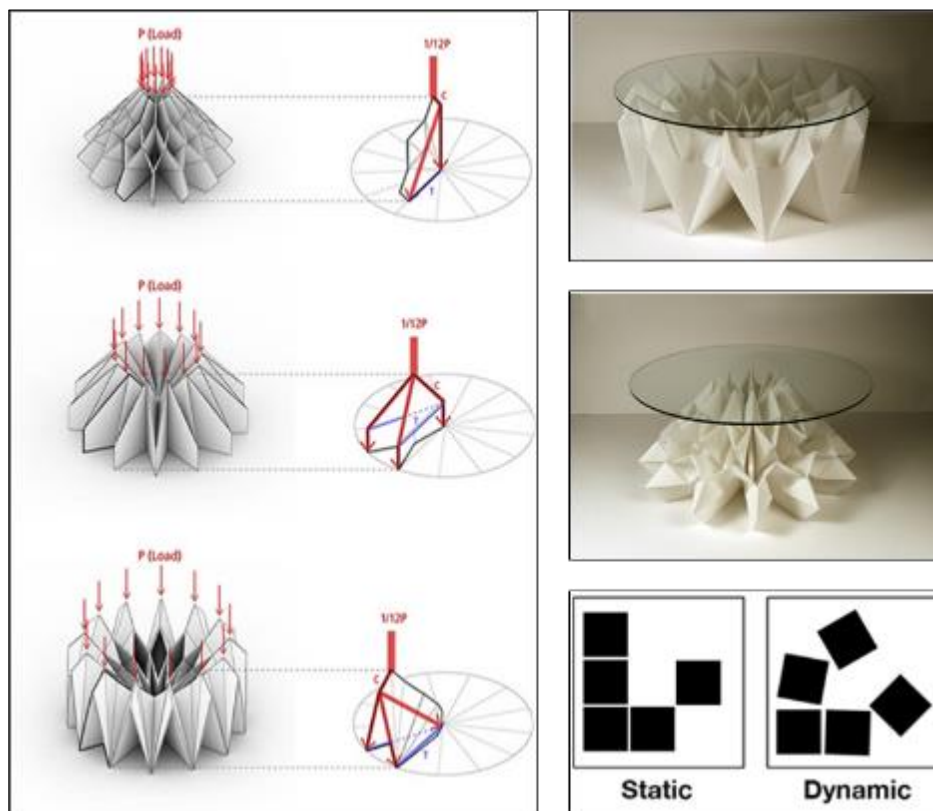


Figure 1 Analysis of Dynamic Design and its role in developing contemporary design thought

3 Concept of Movement in Interior Architecture:

In a form of recognizing motion metaphorically, without real motion through changing architectural form particulars, and as a result of construction technology development in terms of construction means and materials, this resulted in developing motion concept to clarify real motion in interior and exterior architectural works whether wholly or partially [1] .

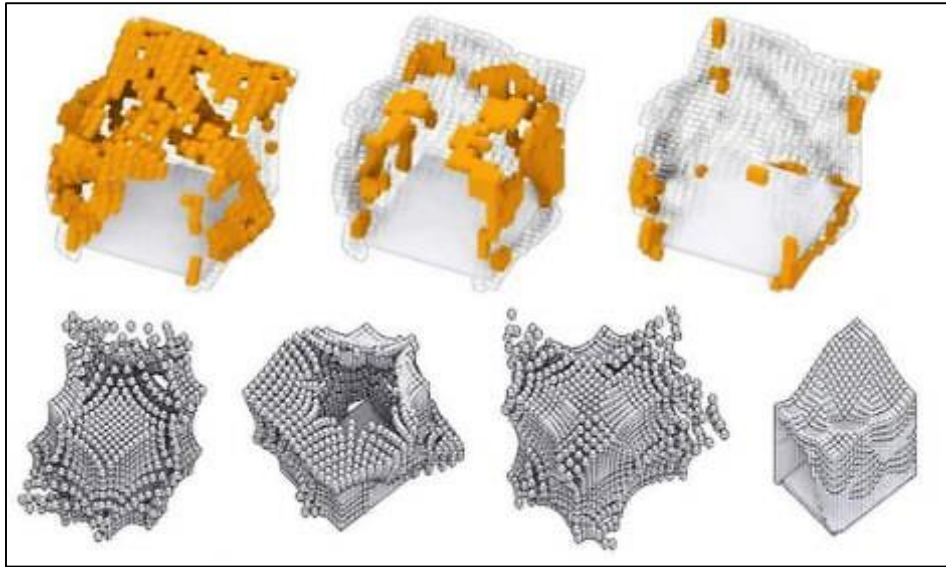


Figure 2 Dynamic Designs and its Relationship to Design Ideology Development

4 Nature of Dynamic and Static Spaces, Dynamic Space Characteristics

Dynamic Form System: Can be subdivided to 4 sections:

4.1 First Section: Material

Form arising from material and its linkage techniques and this form is a product by using this material and its techniques, but it remains a form when taken from the arising material and is used as a structure in another material.

4.2 Second Section: Motion Copy and Abstraction

In form and all un-architectural and un-structural forms, that means that for some structure and relationships with certain practices in surrounding designs and when designer uses such forms or their abstractions, he targets meanings related to the entity it represents and its moral links.

4.3 Dynamic Formal Characteristics and Conversions

Formal conversions are changes of form to reach the final stage by responding to external and internal multi dynamics.

4.4 Third Section: Abstracting Regular forms to Reach Dynamic Designs

The study of scale and its classification into three types:

- Mechanical Scale: specifies the scale of something in accordance with a certain measuring system, as the Empirical system with Inch as the measuring unit for length.
- Visual Scale: specifies how big or small an element is in comparison to surrounding space.
- Human Scale: specifies the human being as a measuring unit, to which every used element is referenced.

4.4.1 *Dynamic and Static equilibrium in Interior Architecture*

Static Equilibrium: in which loads are transferred directly to the ground, as in Beam-Column structural system[2]

4.4.2 *Dynamic Equilibrium*

In which loads are transferred from surfaces to the ground through a group of sections varying in size, shape, and direction. The axial forces in such sections are transferred to structural elements as resultants and then get transferred to the ground, where observers can track how forces are transferred from one point to another.

More recently, there is a direction towards using safe structural instability as a point of attraction and a change to conventional forms.

Of form is the abstract engineering system, it is the only section in which the form is abstracted except main relationships constituting system and according to this status, it will be international and common.

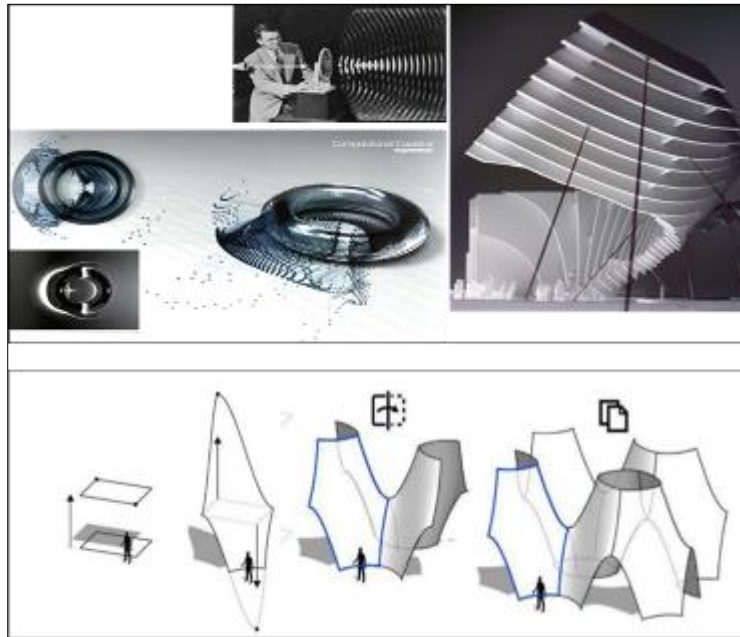


Figure 3 Ans Jenny- Sound Creates Form

4.5 Fourth Section: Deletion and Addition Norms

It is the cast system of dynamic form system, they are such systems which acquired their systematic relationships through frequent use, accordingly, this section relates to what was discussed when we transfer a certain technique form to another material[3].

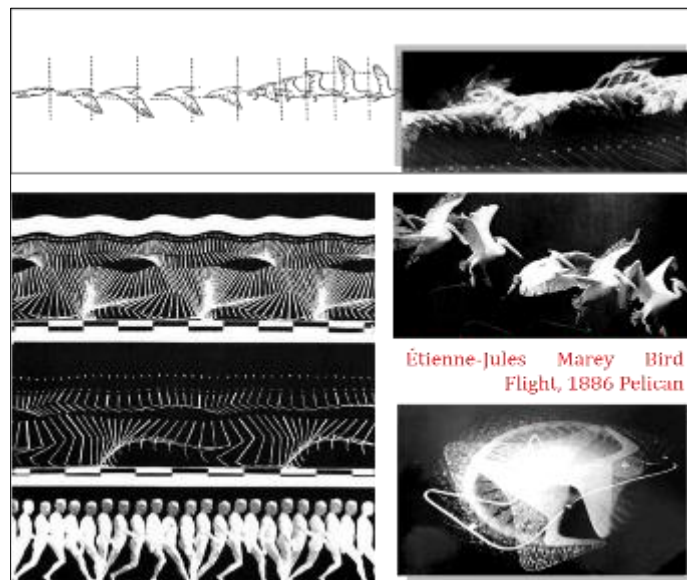


Figure 4 Artistic elements in both of Dynamics branches, Kinetics and Kinematics

Dynamic and Static Spaces and Interior Spaces Treatments, Space Structure of Dynamic Interior Spaces and Its Types Such characteristics can be obtained in addition to the succession characteristic of these arts.

- As time is effective in interior spaces design, we can consider time harmony characteristics.

Of principle which affected interior dynamic architecture arising from dynamic ideology as it is the stable expression which reflects on the form which considered it as changeable [4]

The concept of stable and changeable was discussed in another form to be related to formal elements nature indicating dynamic structure, the stable is related to some buildings formal elements and the changeable indicated some formula of these elements related to some different factors, they related to stable and variable factors with time and space as follows:

- Stable Factors: Having static effect and one unchangeable whatever space and time maybe.
- Changeable Factors: have dynamic nature, unstable and their effects depend on time and space.
- Plastic Treatments and Visual Perception of Interior Spaces

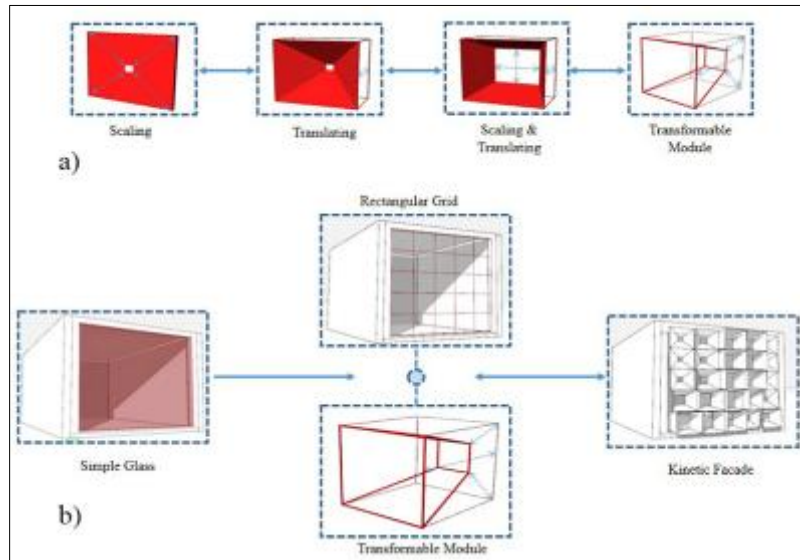


Figure 5 The standard cases of change to motion are classified as the following

- Change in motion direction: were change in directions of motion field is affected by the force applied.
- Change in motion type: by changing the object's position in space.
- Change in motion rate: in the form of acceleration or deceleration resulting from the variation of elements velocity concerning time.
- Change informing properties of moving bodies: in which dimensions of bodies change, either by getting bigger, smaller or gradually changing from one form to another.

4.5.1 Processes of Manufacturing and Digital Production for Dynamic Designs:

Some processes assist in solving different manufacturing problems, these processes pass in 2 different directions: the first direction from digital model to form creation, this direction is the main direction of manufacturing. The other direction is opposite to the first where the transfer is from the minor model (Maquette with a great scale) to digital form [5].

- 3D survey (from physical to digital)
- Means of transferring forms from physical to digital

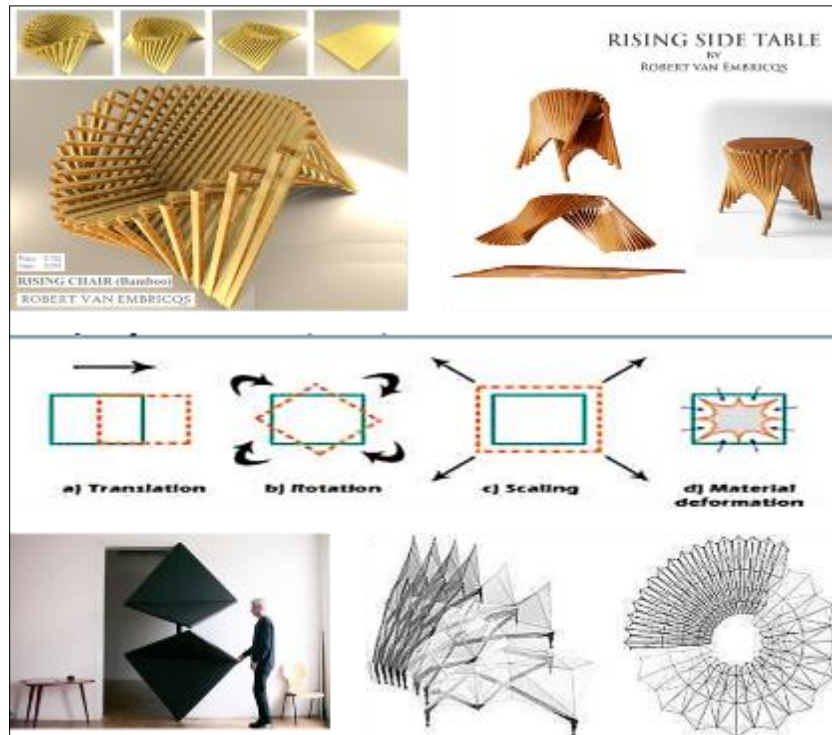


Figure 6 The cognition of motion elements in space matrix

5 Dynamic Design Norms

There are design norms that determine the human relationship to place at different levels through which work can be evaluated as it rises for giving the design its final form:

Permeability, variety, legibility, robustness, visual appropriateness, richness, personalization, and dynamic design is achieved through a balance between such norms to reach a successful architecture space suitable for its purpose and meet user's desires the so-called architectural design responding to the environment and human using this space.

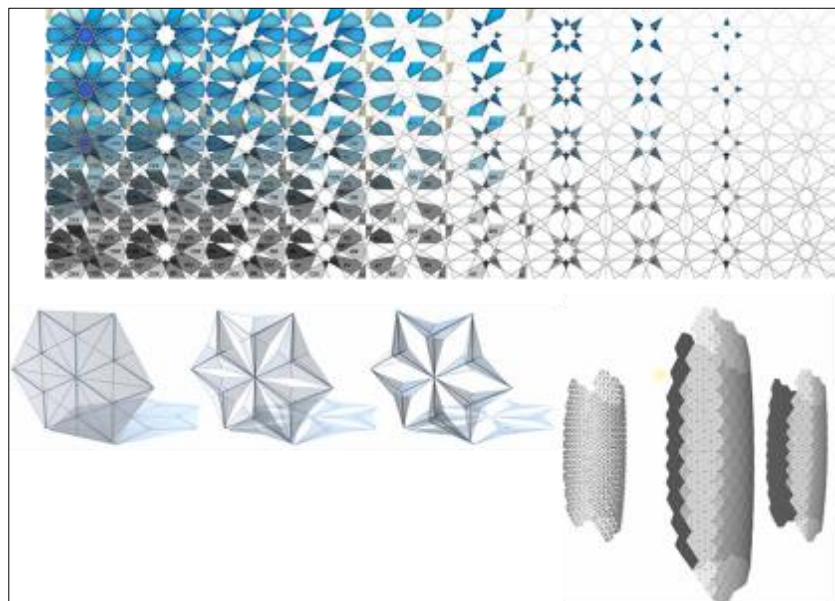


Figure 7 How Dynamism focuses on the effect of Force on moving objects, taking into consideration both its magnitude and direction. Thus, it is important to take a closer look at the relations resulting from force effects and how they affect moving bodies

Using New Technological Techniques for Making Interior Spaces Treatments was discussed through studying: Effects of New Techniques and Developed Materials:

- Characteristics, basis, and causes of using dynamic architecture.
- Dynamic buildings efficiency in achieving dynamic perception.
- Future vision of applying dynamic systems in interior design

A control system is a device, or set of devices that manages, commands directs , or regulates the behavior of other devices or systems. Control systems are used in industrial production for controlling equipment or a machine.

The Control system consists of two elements:

Inputs: are represented in sensors and input different methods, which give different information about the surrounding environment. There are five modes; Manual Input, Sensors & Detectors, Prior Internal Information, Manual Programming , and the Internet.

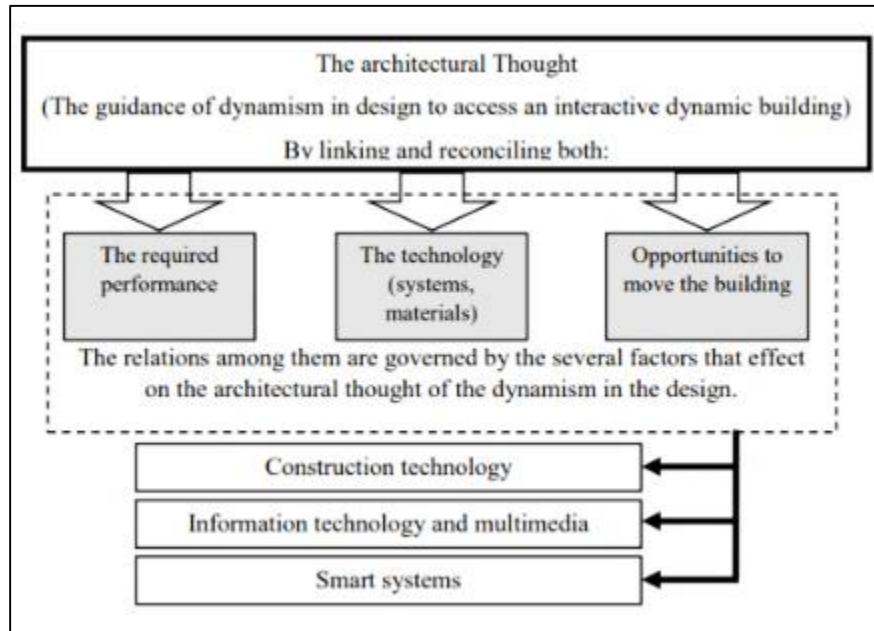


Figure 8 The methodology for guiding the dynamism in design to reach an interactive dynamic building [1]

Which assisted designers to consider new dimensions during design as there no opportunity is for determinates related to the difficulty of or disability to ideas execution to allow them to enter a new world and new theories.

Dynamic repetitive-motion processing depends on repetition and unity of form appropriations. Thus realizing form stability and restricting motion paths. This creates an active dynamic of spaces formed from repetition. Accordingly, vertical lines with varying heights are used to achieve form dynamism, elasticity, and individuality in both depth and height.

Design vocabulary can be summed up into the following elements :(Formation -Form -Color -Texture -Light)
 First cognition is mainly dictated by cultural backgrounds, which helps identify known objects in the first place. However, the following stage focuses on the properties of objects and how they interact with each other, which control the quality of beauty in a visual environment [6].

That is why knowing such Interior Design vocabulary shapes the properties of any visual environment is needed.

Simulation and motion abstraction in form and every other non-architectural or nonstructural one, in which the appearance and its relationship with particular design practices surrounding us, allow designers to use such forms and their abstracts [7].

Those designers seek interpretations related to entities these forms represent and the emotional connections that come along with them. Innovation sources and formation sequence in Interior Architecture, where interior designers get inspiration from their surroundings [8].

Their innovation in architectural formation lies within their ability to interact with and adapt such forms to suit the purpose in which they are used.

5.1 Smart Materials and Design

If the visual effect of buildings is related to the material constituting the visual surface, and material is the surface and its components, this effect has a great role in identifying things, stone, for example, gives a sense of stability, strength and roughness, wood gives a sense of warmth and metal gives a sense of solidity and strength[9].

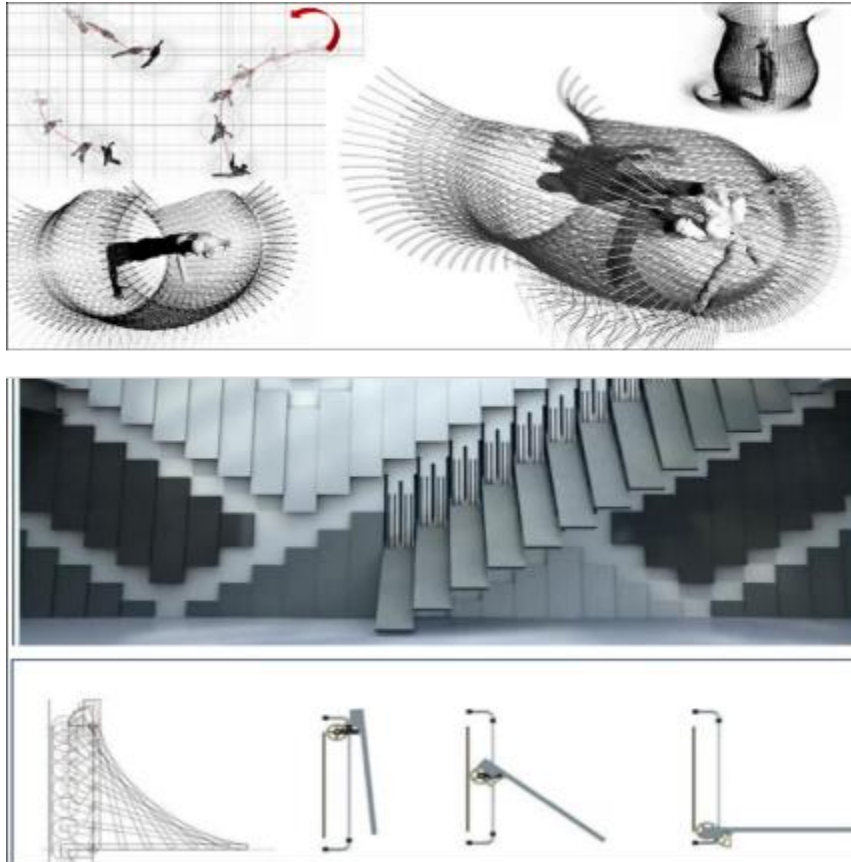


Figure 9 Applied models of foldable and changeable stairs (straight/circular) using intricate control systems

5.2 Space as a Motion Transferring Medium

Space elements conversion to smart electronic elements with programming and preparing with technological methods achieved reaction with visitors, there were activities and ideas looking for transferring spaces to a recreation and culturing method through developing reaction systems and using sensors and control systems [10].

Systems thinking and the construction, in computer-based design practices, of architectural objects as totalities, as integrated phenomena, and as autonomous devices show the relationship between the systems view and the discourses is about the autonomy of architecture, quite common in practices of digital design, as well as the connection between the systemic approach and the trend to think of design problems about biological metaphors in digital architecture [11].

Considering that the movement is one of the branches of mechanical physics, the typologies of actual movement in architecture can be divided into five types [12]:

- The movement of rigid architectural elements.
- The movement of deformable architectural elements.
- The movement of soft and flexible architectural elements.
- The movement of elastic architectural elements.
- Pneumatic forms.

6 Conclusion

Scientific and Analytical Applications of Studies of Digital Dynamic Architecture Age:

An expression means outage which began with developing techniques assisting in achieving ideas of many complexities, in mass, space, and construction "interior architecture engineering will not need vertical projections, sectors, elevation and facades to replace traditional means in dealing with building from 2D image to dealing with the whole building through 3D model" the affair which resulted in different design stages relation to execution through CAM/ CAD and CATIA in an integrated organization.

Basis Which Should be Available in the Dynamic Design Idea and Discussing Analytical Models for Dynamic Ideas, Treatments, and Designs:

- They shall arise from design problem or at least has a relationship to.
- They shall be general, primary a beginning to the appearance of external and internal architecture producer character.
- They shall be progressive and of course, this shall be followed usually the concept is the designer's way to deal and communicating with a design problem to which he is exposed through an occupational problem of design work, also it will be his means of expressing intangible design problem in a form of physical work or formulation through which detailed design process can be initiated.

Compliance with ethical standards

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Disclosure of conflict of interest

The author declares that there is no conflict of interest.

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