

البحث رقم (٥)

Forming High Complexity Scenography by Using Parametric Design

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The Purpose of the Research:

The purpose of this research lies on the following matters:

- This research explores the use of parametric design in theatrical scenery design.
- Enriches the scenic design with the parametric design and opens up new horizons for create designs of high details and complex forms in theatrical performances.

Research Objectives:

The objectives of this research are as follows:

- It draws attention to the abilities of an advanced new trend called "parametric design "which can be used in theatrical performances.
- It opens up the prospect for researchers in theatrical design.
- It suggests endless possibilities in the theatrical scenic design with the use of parametric design.

Research Questions:

This research attempts to answer the following questions:

- How might the new trend called" parametric design" affect the process of scene design?
- Can we benefit from "parametric design "to enrich the visual language of theatrical scene?
- Can we employ "parametric design" in the design and reforming visual image in the theater?
- How could the new trend" parametric design" improve the visual language?

Hypotheses:

Through this research, the researcher expects to reach the following results:

- The ability of such new trend "parametric design "to bring high complex and accurate details in the visual image.
- We can take advantage of such new trend "parametric design" to enrich visual vocabulary in theatrical design.

Research Methodology:

The analytical deductive approach is used in this research through:

- Analyzing different forms that have benefited from such new trend "parametric design" in other fields.
- Deductive study of ways to benefit from " parametric design " in theatrical performances, followed by a proposal by the researcher to use the new trend in the theatrical scene designs.

Keywords:

Parametric design - scenography -Digital Design

Abstract:

Theater has undergone many technical and technological developments, as well as all other fields, the impact of technological development on the stage and its equipment, on the visual image and the whole theater, and many artistic and theatrical trends appeared, whose role affected the theatrical image, with the digital development and the emergence of computer programs. This affected the design process of the theater and theater lighting, and enabled designers to create and digitize their theatrical designs. Computer software has continued to develop and have a clear impact on design, until researchers have developed several computer programs, which can be manipulated by digital variables and mathematical equations and modified by making radical formal changes and end-designs. The designers called these formal variables the term "parametric" from which the architectural trend called "parametric trend" appeared.

The emergence of parametric trends has brought about a shift in the different design methodology and methodologies, where designers have been able to build an infinite number of solutions for the same design and choose them effortlessly, all of which has opened the door to explore many different design capabilities. The research aims to utilize the potential of parametric design and its use in creating endothermic, high-resolution, and infinitely variable scenes, by modifying the parameters or formal variables of design, to open up new horizons in the design of the theater with the use of the parametric design. This will represent a major transformation in the theatrical design of its wide features in the theatrical scenes.

Introduction

In the last twenty years, there has been a radical change in design, since before the 1990s, sketches, maquettes and drawings were used to express different designs^{xxxii}, and after the advent of computer software in the design in the 1990s, the designers began to make use of them in the work of their various designs. In the past few years, computer software has seen a significant leap in its features and capabilities that have enabled designers to create highly complex digital designs, generating new patterns of complex digital designs that never existed before, such as virtual design, Parametric design, and other complex digital designs, which could not be designed without specialized computer software.

Parametric Design is a design that was generated with the digital system and its application software to create a complex design according to a synthesis system, computational laws. This type of design aims to achieve complex innovative designs through the dual intellectual exchange relationship between the design thought of the designer and the computer software specialized in the work of the parametric design, meaning that the designer can design and modify its formal variables to get other complex and unusual designs.

The concept of parametric design is based on geometric basics, mathematical logic, and a set of geometric coefficients inspired by the nature laws of different organisms, and the parameter is software spaces containing a set of algorithm. The importance of parametric design is to provide a new design tool for designers to create unusual and complex design forms, which were impossible to design before The emergence of computer programs that are specialized in this type of design.

Parametric Definition:

The word parametric is derived from the word "parameter", which in turn is taken from the Greek word para meaning "beside" and "metron" which means measurement.

The word "parameter" is defined as any measure of a system, or data and information that affects the state of design, and there is also a mathematical meaning of the parameter, which is due to changes in values in the results of mathematical equations.^{xxxiii}

"Parametric design" is called "boundary design", "standard design" or "variable design", and means the process of creating a design by manipulating its variables and by changing those formal variables the form of design changes, enabling the designer to find unlimited solutions and designs.^{xxxiv} The parametric design can also be designed by programming or by typing special codes in specialized programming languages.

The Impact of Parametric Trend on Architecture :

In 1964, the designers stated during an architectural conference in America that the computer would help to create complex shapes and surfaces, which would enable scientists to use it to calculate and construct complex structures for aviation, and simulate flight traffic routes that need accurate calculations. Raphael Roig, a student at the University of California at the time, expected in his unpublished thesis of the Master: "Computer technology will be able to reduce construction time, as well as increase the ability to create complex designs," and during the 1960s, many architects such as Gaudí created designs for complex forms and surfaces.^{xxxv}

During the 1980s, designers benefited from scientific advances in biological sciences in designing their parametric designs, designers benefited from the equations, rules and mathematical laws discovered by nature scientists, and applied those mathematical equations to their designs, and they became highly complex and unusual designs. In the late 1980s and until the mid-1990s, computer and software designers developed for space science were used to move shapes and configurations, the architect and designer Greg Lynn used the computer to generate various designs called folding and blub shapes. The idea of its digital designs is based on the use of codes for genetic systems, which can be manipulated by the component lines of the design and modified by changing the final form of the design.^{xxxvi}

In 1995, a designer named Ben van published an article on an architectural project, stating that the computer was an important tool in visualizing large urban infrastructure by introducing a set of parameters. After that, studies and researchs continued and the idea of parametric design and its applications developed by architects, including Zaha Hadid, until one of the designers "Yosuki Ubuchi" formulated the parametric design principles in 2002 in his thesis of the Master.^{xxxvii}

Recently, the term "parametric design" has been used extensively and a special expansion in architectural design, mainly associated with the use of advanced digital techniques and used in complex projects, used CAD architects to help them visualize their ideas, and a parametric design is a rapid development of CAD software that allows designers to identify the main points of the design, and make changes or modifications in the formal variables of the design on a continuous basis, Whenever a change occurs in the formal variables, a change occurs in the rest of the other variables automatically.

Phases of the Construction of the Parametric Design:

The three-dimensional digital parametric design steps are numerous on specialized computer programs and even the final form of a 3D object is reached through the following steps:

1 - Establishing the Parametric Design:

The first step in creating a parametric design is to create a 3D design, whether it will be a wall, furniture unit or 3D block, and many sophisticated programs have emerged that specialize in 3D design work. These digital software specialized in parametric design provided the possibility of using specialized digital computational equations that apply them to design that can obtain complex designs, and provided designers with large, time-consuming calculations.^{xxxviii}

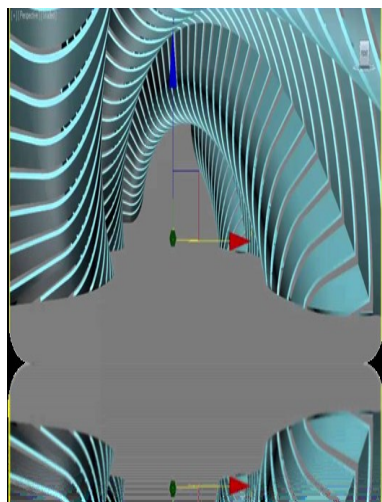
There are two ways to prepare parametric design:

The first method: The first method is to use special programs such as "Maya", "Grasshopper", "Autodesk Revit", and "Reno Rhinoceros" which work in a way similar to 3dmax in the use of different commands, but differ from that those programs use preprocessed 3D forms, we do not use lines , curves and we can make adjustments to reach the desired design as (Fig1)

The second method: The second method is to draw the horizontal projection in a program such as Maya. The computer will deduce the rest of the other engineering drawings until the design reach three dimensional form . This is done spontaneously and changes with the evolution of horizontal projection .

2- Implementation of the Design Three-Dimensional Form:

Next comes the implementation phase, by inserting and uploading digital files of the engineering drawings of the 3D design, which were prepared in the previous phase, on the CNC flutter devices, and the machine cuts the 3D design chips individually according to the coordinates of the 3D design chips. The machine makes longitudinal and transverse slides of the 3D form structure, and uses various materials in 3D design work such as wood or cardboard (Fig2).^{xxxix}



(fig2) Laser cutting machine that cuts longitudinal and transverse design slides according to the three-dimensional design coordinates.

3 - Assembly and Finishing of Form:

After cutting the longitudinal and transverse chips of the three-dimensional structure, the assembly and finishing phase of the units comes in the desired final shape, the chips can be assembled, installed, and joined together in an engaging or other way depending on the strand used, and the solid rods can be used to assemble and bind the chips to reach the desired three-dimensional design (Fig3).^{x1}

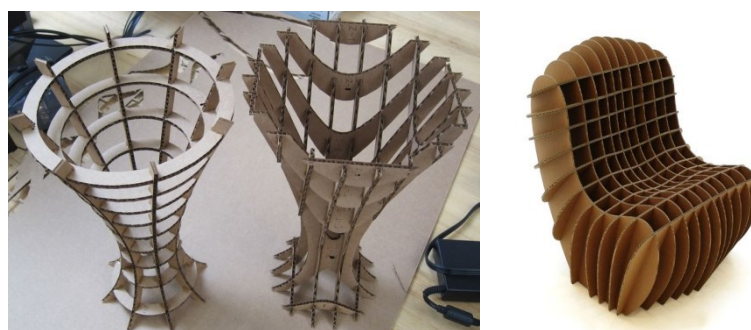


Figure (3) Different examples of parametric furniture units

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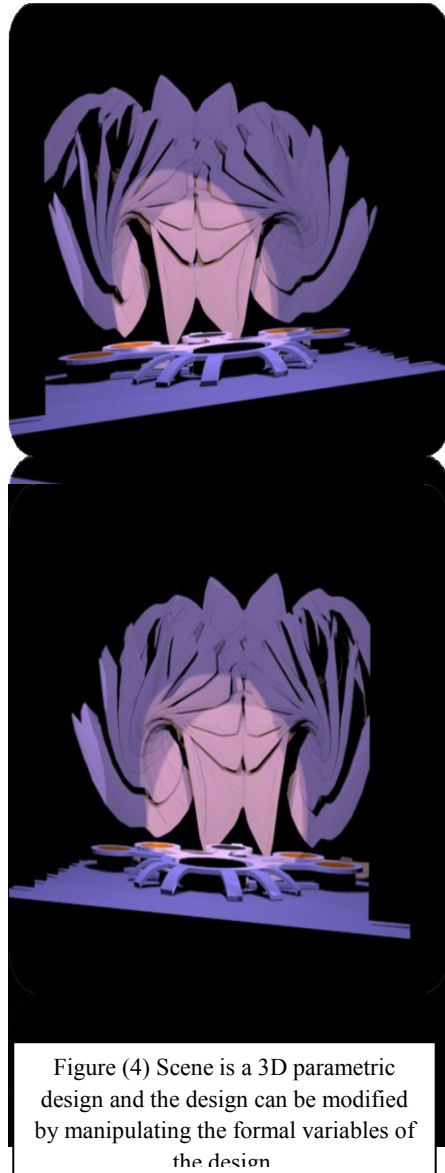
The research presents the idea of using the parametric design trend and using its capabilities in the formation and design of a changing scenes, in which changes and endless changes can be made using some sophisticated computer programs, and by modifying the parametric design variations, we get the designs and configurations of a complex, variable, and unfamiliar, theater-style. It can be used in musical performances, events and fashion shows, in addition to fictional, fantastical shows and other different types of theater performances.

The researcher used a number of different computer programs specialized in the operation of complex parametric designs, and after the design process the cutting stage of the 3D shape comes - as explained earlier - by inserting and loading the 3D design files of the proposed theater designs on the CNC shredder, the machine cuts the 3D design slides - each chip individually according to the 3D design slide coordinates.

The machine makes the longitudinal and transverse slices of the three-dimensional body structure, and the wood can be used for making the longitudinal and transverse slices of 3D designs, then the assembly and finishing phase of the various slides, combines the three-dimensional design with the three-dimensional composition and interlation of the slides, and the rigid bars can be used to assemble and bind the slides, forming the three-dimensional scenographic design.

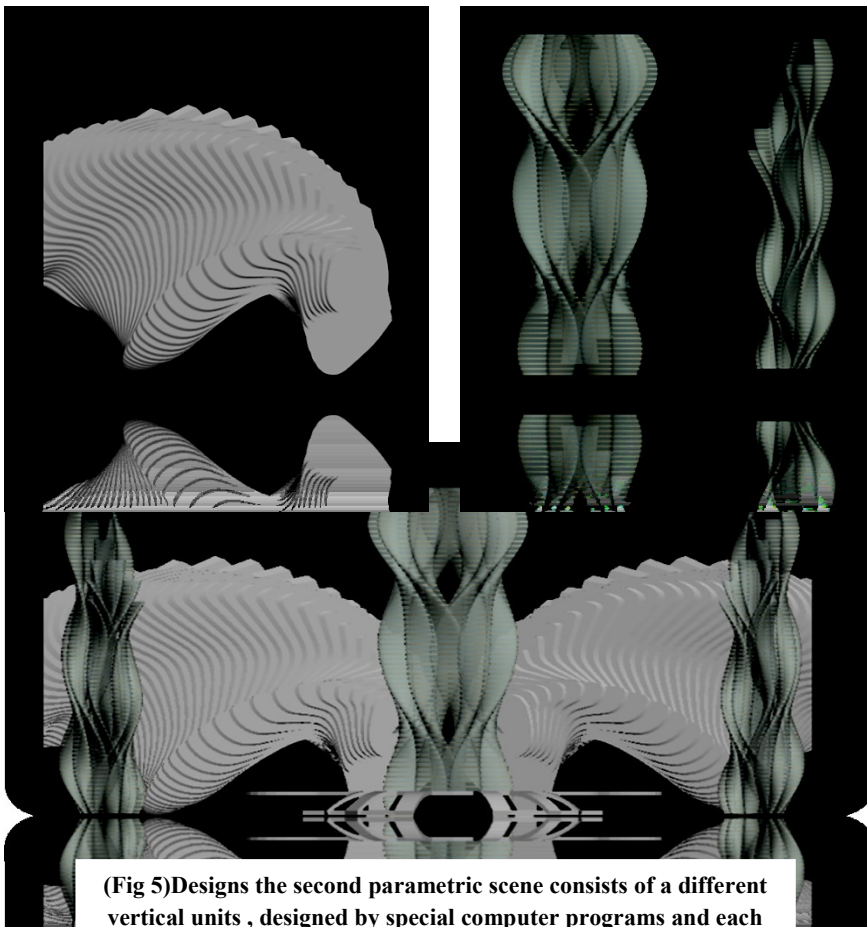
First Parametric Scene:

The design of a streamlined scene consisting of vertical units with a repetitive unit of different rhythms and a parametric design consists of a number of organic slides in the background of the stage, the foundation of the design concept is a repetitive unit in different rhythms, and using different computer programs the three-dimensional parametric format is designed to reach a scene that is suitable for different theater performances, especially in science fiction, artistic, abstract, and other performances (Fig4).



Second Parametric Scene:

The scene is a free form design that consists of a number of different 3D paramorphic vertical configurations, and the researcher designed a modular design that is replicated in varying sizes and rhythms, used in its design different 3D computer programs, each form of vertical units consists of a large number of repeating slides, and by manipulating the paramorphic variants for each 3D vertical element that make up new and different configurations, and below that show the cinematographic interface (Fig5-6).



(Fig 5) Designs the second parametric scene consists of a different vertical units , designed by special computer programs and each form of vertical units consists of a large number of repeated slices



Third Parametric Scene:

The design is a complex interwoven process of parametric organic forms that can manipulate the formal variables of each part of the composition, automatically modify and change the rest of the composition, and each three-dimensional composition is a large number of organic slides, infinite form modifications in design that allow for variable scenes and varied musical, events, and fiction designs, artistic performances, and various events (. (Fig7-8).

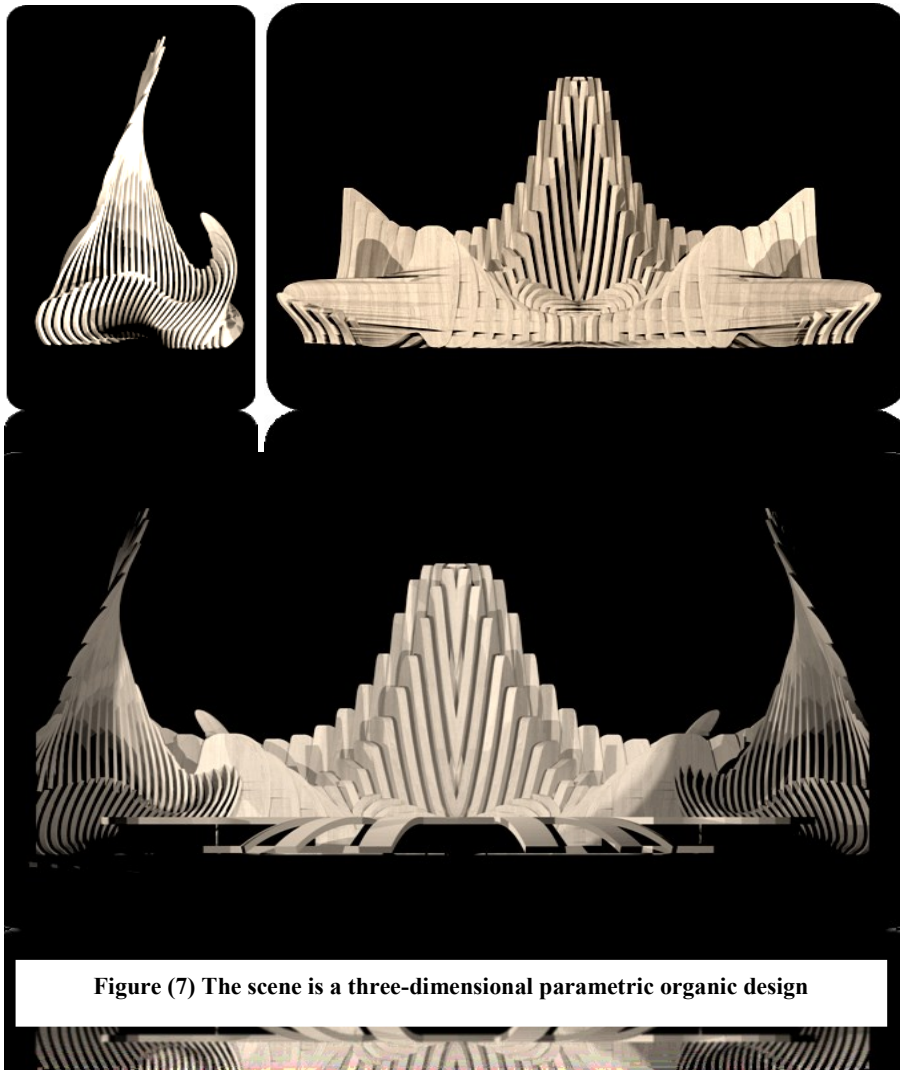


Figure (7) The scene is a three-dimensional parametric organic design

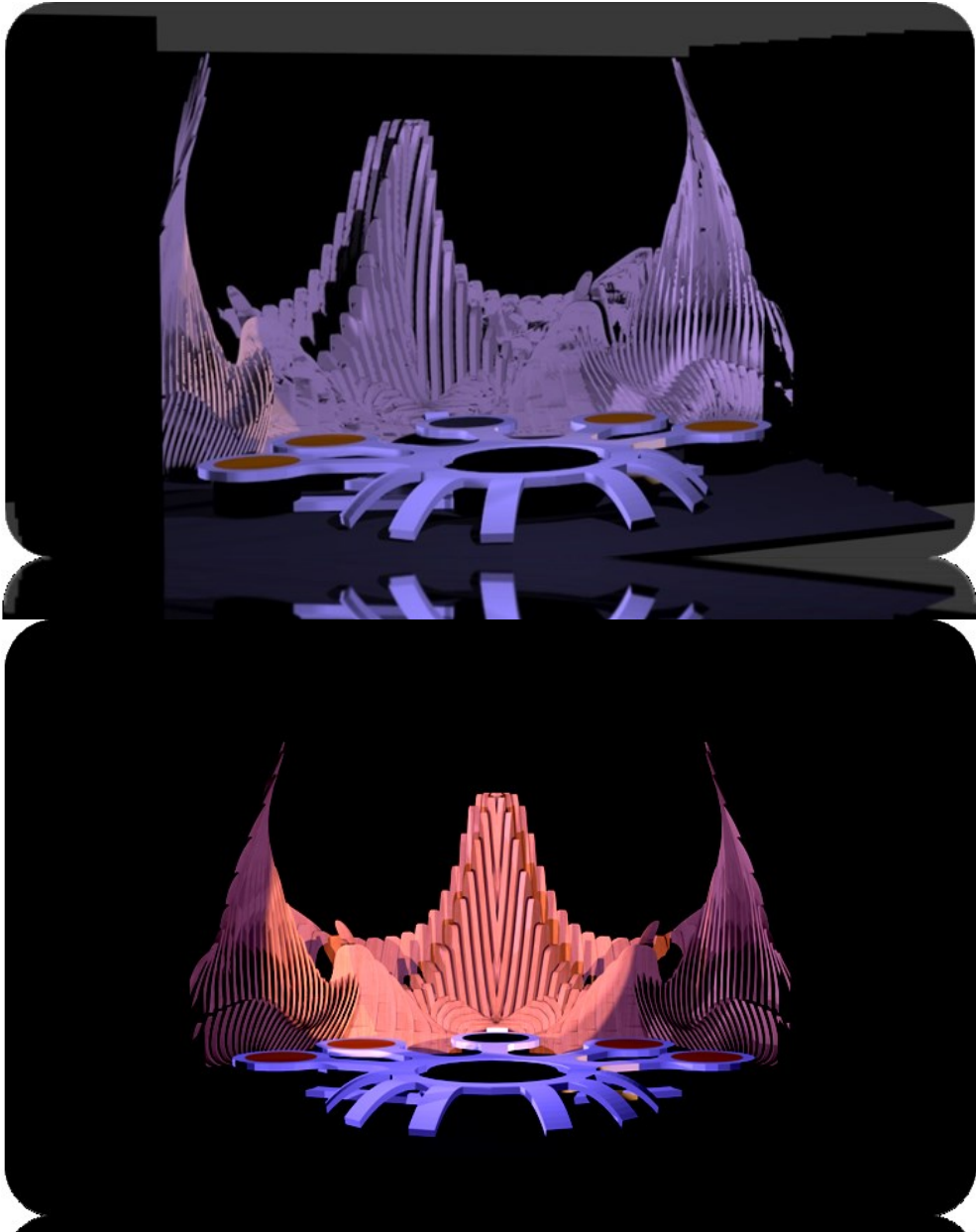


Figure (8) The scene is a 3d parametric design

Conclusions:

The emergence of the technical revolution has undoubtedly influenced the field of visual and performance arts, especially theater, and the scenic design is no longer limited to classical rigging and techniques, but rather as a result of the high scientific progress in the various fields of computer programs.

Evolution is no longer confined to digital programming as a digital tool for the creation of 3D designs, but it has evolved into a part of the design process. The forms of theatrical scenography have become the final result of a design process that is directly influenced by digital programs.

Numerous trends have emerged in digital design, born from architectural thought in the field of architecture and other scientific fields in the late 20th and early 21st centuries. These digital trends have led to a major breakthrough in architectural design.

These trends include parametric design, fractal design, and other modern digital trends. All of these trends depend on complex mathematical processes and equations that are attached to specialized computer programs. By applying design equations, we have complex design configurations that would not have been possible to create without these specialized digital programs..

The research presents an idea of taking advantage of the possibilities of one of these complex digital trends called "parametric design" and its use in the formation of high-precision and complex theatrical scenography and infinitely variable design by using specialized design programs to obtain innovative scenography

The aim is to open up new horizons in the design of the scenic design using parametric design, which will constitute a breakthrough in theatrical design that could have been designed by traditional methods of scenic design.

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