

## Employing the parametric analysis principles in metal furniture design

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### Abstract:

Furniture is an integral and inseparable element of architecture, and its design depends a lot on its function and the space in which it will be placed and its consistency with the place. Some furniture units were executed in different eras in a beautiful manner and with great skill, so they came back from wonderful works of art and deserved to occupy their proper place in museums because they are pieces of art. In the twentieth century, a number of architects, designers and furniture makers came up with making artistic furniture units that took into account the aesthetic aspect, and sometimes at the expense of functionality. At the present time, parametric digital systems have been relied on to find artistic aesthetic formal systems that take into account form and function. Where the analysis represents Parametric has recently been a trend that allows designers to explore new forms of meaning within more complex geometric systems. The design systems resulting from this trend are characterized by being mathematically based in an algorithmic form, where the methods taken by the designer can be determined when modeling his design and thus can be simulated digitally. Where modern digital design methods can play a role in the emergence of the parametric form as one of the most important pillars of the physical image of products in general and metal furniture the focus of research in particular through its ability to achieve connotations and visual messages that it presents to the recipient, and the parametric form can be realized in the design of metal furniture by realizing Laws regulating perceptions from a parametric viewpoint in furniture design. Therefore, this research aims to explore the mechanism of employing the principles of parametric analysis in the design of metal furniture, and to achieve this goal, the research was divided into three parts. The first dealt with metal furniture (concept and design methods) ,While the second reviewed the methods of analyzing and finding the parametric form. The research ended with the third part, which concerned with studying the principles of parametric analysis for the design of metal furniture. The research concluded that parametric design tools can explore important relationships by achieving design and engineering purposes, which are carried out through the designer's interaction with parametric tools through rule algorithms to capture and process these relationships, in addition to generating parametric forms and relationships between different design elements.

### Keywords:

parametric analysis principles - metal furniture- parametric design

**Research introduction:**

Man has needed furniture to achieve physical comfort since ancient times, and the main furniture units remained diverse in their forms, types and functions throughout the ages; Although its general appearance has not changed much, its patterns, patterns, decorations and methods of manufacture have changed between one era and another and one place and another. Furniture is part of the environment that man creates for himself, and the history of furniture reflects man's view of his living affairs and level of development in every time and place. Furniture usually consists of basic units and units dedicated to specific functions, and the furniture may be fixed or movable. Furniture units are classified according to function into pieces intended for comfort, such as beds, sofas, chairs, stools, and tables, and pieces intended for preservation, such as boxes, cabinets, and libraries.

With the development of methods and methods of design and keeping pace with technological development, there are many methods and trends of design until there is compatibility between the capabilities of technology, manufacturing capabilities and the creativity of the designer. Digital design and parametric design based on design thinking, digital manufacturing and linking cad / cam systems. Thus, modern digital design methods have played an important role in the emergence of the parametric form in product design in general, and metal furniture the focus of research in particular, through its ability to achieve connotations and visual messages that it presents to the recipient. From a parametric point of view in furniture design. As the reliance on parametric digital systems to find artistic aesthetic formal systems that take into account form and function by employing the principles of parametric analysis, which would work to explore innovative and new meaningful formal systems within more complex engineering systems. algorithmically and thus can be simulated numerically.

This research deals with the study of employing the principles of parametric analysis in the design of metal furniture; Where the research was divided into three main axes: the first axis deals with metal furniture (the concept and design methods); While the second axis reviews the methods of analyzing and finding the parametric form; The research ends with the third axis, which is concerned with studying the principles of parametric analysis for the design of metal furniture systems

**Research problem:**

The research problem is the gap between the applications of parametric technology at the level of design and manufacturing, and the professional practice of the process of designing metal furniture.

**search objective**

The research aims to find an organized design pattern that can be followed in the parametric design of metal furniture through the principles of parametric analysis.

**Research hypotheses**

The shape and shape parametric analysis system can design metal furniture units of various shapes and shapes.

### Research Methodology

The research follows the descriptive analytical method in studies related to the study of parametric analysis and the design of metal furniture.

### Research Results:

1. Parametric design tools can capture and explore important relationships, by achieving design and engineering purposes, which are done through the designer's interaction with parametric tools through rule algorithms to capture and process these relationships, in addition to generating parametric shapes and relationships between different design elements;
2. There are many methods and methods for designing parametric metal furniture, where ergonomic aspects of the main composition, materials and functional use can be integrated into metal furniture. Metal furniture can also be used to achieve specific shapes and functions inspired by nature, and also achieve the external shape of the product for a set of cognitive and communicative functions;
3. The principle of the Lindenmayer System for parametric analysis can be employed in the design of metal furniture by exploring formal rules that are conceived as a theory of plant growth (Fig. 12). And then come up with complex shapes using relatively simple rules.
4. The principle of the Voronoi diagram for parametric analysis can be employed in the design of metal furniture by exploring a mathematical and geometric system by analyzing the parametric space defined by a discrete set of points;
5. The principles of voxel-based geometry, the principle of Norbus geometry and the principle of self-organization of the pattern can be employed in the design of metal furniture (Fig. 13) by dividing the multi-dimensional space into subspaces, and the main characteristic of the processes of obtaining order is from randomness through the internal interactions of the system without any external interference .

### Search recommendations:

1. The designers pay attention to the scientific principles and the different parametric design patterns
2. Attempting to apply the different principles of parametric design to the designs of metal furniture in order to find new forms and innovative design solutions
3. Paying attention to modern computer-based technology manufacturing systems and identifying them by designers in order to achieve the shapes designed with parametric principles on the ground.

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