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POSSIBILITIES OF APPLICATION OF PARAMETRIC DESIGN IN ARCHITECTURES

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Abstract: *Parametric architecture is created by computer programs, but the parameters are set by a person. About the concept of parametric design. An understanding of digital design and technology programs that are becoming increasingly popular in world architecture. In the last few years, topological optimization has been very actively used by designers and engineers. The power of modern computers is the use of genetic algorithms, when millions of possible combinations of parameters change with a certain final result, with sufficient rigidity and minimal weight. The resulting parametric structures are unlike anything previously created by humans. In this regard, it will be considered in this article.*

Keywords: *innovation, kinetic architecture, parametricism, pavilion, design, technology, building, form, color, project, complexity, mobility, modernity, construction, generation.*

INTRODUCTION

The main part. Throughout human history, artists have used two types of objects - "pure" geometric forms and, to a lesser extent, creations of animate and inanimate nature. In the second case, it was about simple copying. "Today, the development of information technology has given the artist two new wonderful tools. First, computers allow the generation of random numbers, which the human mind is not capable of. Secondly, the computing power of modern computers is enough to simulate really complex processes that are no different from natural processes, Tatyana explains the nature of

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parametric architecture. Unprecedented creative freedom is one of the most beneficial features of parametric architecture. This approach works best for overlapping criteria or multiple criteria. It is indispensable for the rapid creation of very complex shapes, which are not easy to implement with standard design methods. Developers of parametric plug-ins for various graphic modeling packages such as 3D Max, Autodesk or Rhinoceros work closely with designers. Sometimes new programs appear on the market without any additional and educational documents - the authors are in a hurry to share new ideas. "All this reminds me of a student rally where young people discuss how to change the world," Grishina smiles. "Online forums for parametric architecture and parametric design software are full of ideas and suggestions."

Patrick Schumacher in his article "Parametricism" predicted a "war of styles" for our society, in which the new natural style will be the winner. Postmodernism almost disappeared, the same thing happened with deconstructivism. And this is not accidental - after all, there was very little accidental in them.

Despite the fact that parametric architecture originates from Europe in a certain sense, there are still few objects created based on it in our country. For example, the benches installed on the New Arbat and the interiors of the small office complex Dominion Tower in Dubrovka, designed by Zaha Hadid. Fig. 1. neither Moscow nor other Russian cities can boast of its art. The young Russian jewelry company "i-o-u design&research.lab" decided to make parametric design the main motive in creating its collections. Figure 1 "Before creating the first jewelry, we studied the work of the best experts for about a year, read scientific articles about the Voronoi diagram. We were amazed at how the computer, working as a full-fledged co-author of the creative solution, helps to create amazing shapes and lines," says Alexandra Grishina, designer and jeweler of the i-o-u brand. A suitable material was chosen for the implementation of especially amazing projects - titanium, which, when electrochemically processed, can be covered with patterns that glow with all the shades of the rainbow. The application of parametric approaches can reduce the time pressure in the design process. The factors in green building, such as solar radiation and thermal comfort can be considered as parameters in architectural design. The so-called parametric design employs certain software such as Grasshopper to efficiently amend and improve the design by integrating and coordinating design components simultaneously. Therefore, any change of parameters like editing or developing will be automatically and immediately updated in the model, which is like a "short cut" to the final model.

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Figure 1 Dominion Tower

Design is a broad concept, and this makes it difficult to try to define it precisely, so the word "design" usually refers to a method of design. In a word, design is a type of human activity aimed at meeting needs and requirements through exchange. To explain this definition, the following concepts are considered: need, demand, commodity, exchange, transaction, and market. Thus, the main idea of design is the idea of utility, beauty and the necessity of human needs, that is, simply put, design is beauty and utility. Also, you can say that design and its types are interesting. Interior design is a kind of art. According to the style of interior design, it is possible to determine not only the taste, type of activity, status, appearance, hobbies of the population, but also their character, mentality, nationality, as well as the number of people living there. at home.

Just as everyone's face is different, even though faces are similar, even a typical interior has its own face. Creating the face of the interior space, its style, color, spirit is the main task of the designer. like music is composed of a series of images superimposed in time and space... The human eye is on average 1.6 meters above the ground. This is the tool we have for perceiving architecture. The human field of vision is very limited; limited to a greater extent by consciousness , he follows the apparatus of vision and perceives, evaluates and measures only what he has enough time to do.This is how the experimental designer and innovative architect Le Corbusier described the perception of architecture.

RESEARCH METHODOLOGY

Forming a style. A new direction in architecture appears at a time when one style has already been "developed", and the second has not yet developed eclecticism - taking individual elements of previous styles. Bad taste doesn't always come from this architectural vinaigrette; often multi-styled, but "delicious" work is still born. A personal interior can be solved in a mixed style, but eclecticism (mixture of styles) is very different from kitsch style (bad taste, anti-art), and the border between them runs along the same border of taste. So, before deciding to remodel a new or old interior, it is better to know and understand the basics of architectural trends or styles. Ancient Egypt. A style that has existed for 4,000 years, it is based on the worship of eternity. It hasn't changed much during its

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existence. The vegetable type of stylization is widely used. In the shrines of the architect, 3 types of columns were used -lotus-shaped (capital in the shape of a lotus flower or bud), papyrus-shaped (capital in the shape of a papyrus stalk) and gator (pictured capital). the head of a goddess (the author is a woman with a dog's head).

Over time, the style became more democratic, funeral scenes were replaced by sentimental scenes of life. Since the discovery of Egypt by Europeans, the culture of the ancient civilization so excited the imagination that, after reworking its main principles, the Empire The so-called imperial style appeared. Interior styles Antiquity. Antiquity is usually understood as the art of Ancient Rome and Greece. This style is the standard of harmony and beauty. The art of this style developed in parallel with the art and laws of Ancient Egypt, but despite the contact between the peoples of Greece and Egypt, it developed independently. Later, harmonious later trends such as Renaissance, Classicism, Neoclassicism were returned from the canon of antiquity. Unlike the Egyptians, the Greeks and Romans had a life-affirming view of life. All the architecture and interior design of the houses were true laws and proportions. A precise science such as geometry played its role in this, resulting in "ideal" forms and proportions in architecture and art. A system of artistic design in architecture was born from the combination of exact sciences and arts: post and beam structures - orders and columns that are still used today. In addition, the role of supports was performed not only by cylindrical columns "borrowed" from nature (tree trunks), but also by columns in the form of figures of gods - caryatids as hymns to man. realized its plasticity. The crown of his creation - St. Peter's Cathedral in Rome is already in the Baroque style.

ANALYSIS AND RESULTS

For most people, the words "algorithmic design", "digital design" evoke associations with things that are inanimate, artificial, contrary to human nature and nature in general. However, this is a misconception, it is worth seeing at least once the work of designers using parametrism. Sometimes it's hard to believe that living, breathing buildings or intricate necklace-like jewelry were created by soulless computers. But the bottom line is that they allowed us to create such natural forms. And here it can be added that Zaha Hadid's architecture office is the most influential in the world of parametric design. One of the most famous works of the bureau is the building of the civil court "Town of Justice" (Fig. 2) in Madrid. His floor plans and sections are now studied by students around the world.

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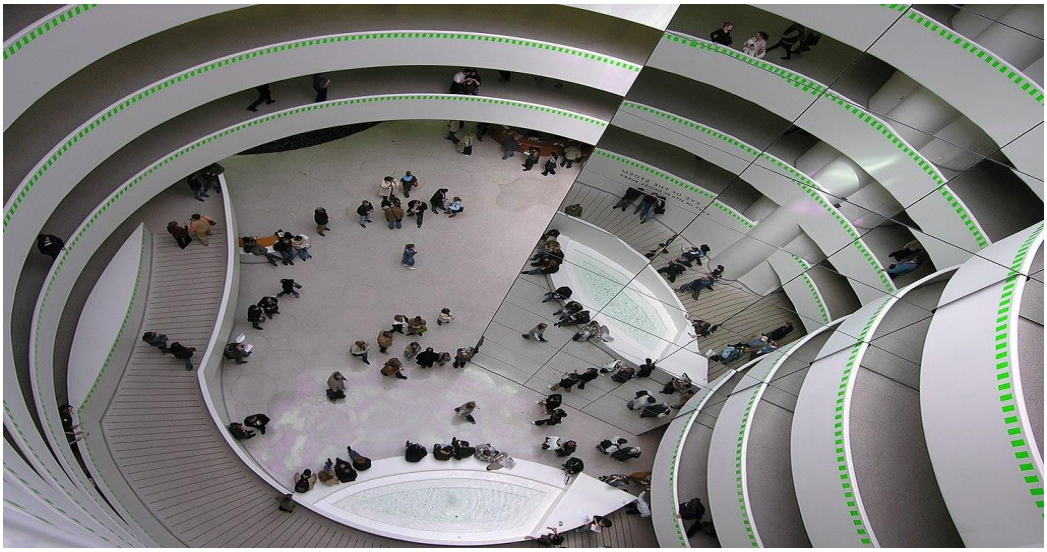

Figure 2. Guggenheim

Technological changes will affect all aspects of the building industry. The entire design process will use digital methods for optimization, computation of data, design evolution, and extends to construction and fabrication.

The Farmhouse by Studio Precht

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Essential factors related to building energy performance are mainly determined in the scheme phase, including building orientation, building shape, and facade design. In this section, an optimization method will be introduced, which serves as the design advisor in early-stage design. This method is based on building information modelling (BIM) and genetic algorithm. The first step is to input building information, including geometrical relations, orientation, etc. The building information modelling has shown its superiority in the efficient cooperation among stakeholders in the building process, as it stores relevant design information of every step in the design process. It serves as an interdependent, multi-disciplinary data repository which enables the input of physical information of the building as parameters in the assessment process. The next step is the calculation. The design of the green building can be considered as a comprehensive and multi-objective issue. Therefore, there is hardly a single, perfect solution.

Thus, a genetic algorithm is applied to find optimized solutions that suit the given condition. A genetic algorithm is defined as a probabilistic search algorithm. It simulates the process of evolution by taking a population of solutions and applying genetic operators in each reproduction. And genetic algorithm provides iterations for the process learning and result optimization.

There are several examples of biomimetic architecture structures: cable structure, thin-shell structure (Fig3 (a)), membrane structure, cavity structure, plate structure, etc. Beijing National Aquatics Center, as shown in Figure 3 (b), is an example of membrane structure. Studies show that its membrane structure is divided into external cushions, air layer, and internal cushion, which meet the multiple demands for heat preservation, heat insulation, natural lighting, and ventilation. Biological forms are usually complicated. The outcome of a morphogenetic process is generated after the interaction between system intrinsic information, material capacities, and environmental influences. Different from computer-aided modelling which models the object, computation is a concept about modelling the processes of how the form is generated, based on constant feedback with digital simulation.

(a) L'Oceanogràfic

(b) Beijing National Aquatics Center

Fig 3. Examples of biomimetic architecture structures

CONCLUSION

This paper has presented a review of three applications of parametric design in green building, focusing on the scheme phase and use phase. The advantages of the parametric method are listed as

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follows. The parametric method provides architects with an effective way to test the more possible variants in the scheme phase and make suggestions for optimization. This makes the form of building more reasoning. In this topic, many papers focus on exchanging data between BIM platform and simulation platform. Autodesk Revit is the most commonly used program to overcome this difficulty. It has an Application Programming Interface that establishes a connection between BIM platform and the simulation platform. However, the cooperation between different BIM programs, such as ArchiCAD and Vectorwork, is still a problem, leading to difficulty in communication. The BIM-based adaptive system shows another possibility for architecture. In the past, buildings are considered immobile objects. Therefore, architects could only adopt passive strategies to save energy. With the adaptive system, the building components can adjust actively to the changing environment and thus save more energy. However, besides the advantages, the author has noticed that there are still some challenges adopting green building techniques in developing countries. Two barriers need to be overcome. One barrier is the lack of databases. This makes the construction difficult, as it leads to the lack of suppliers. The other one is that it's also relatively hard to obtain real-time weather data in developing countries, due to the inability to build more weather station and the insufficient meteorological satellite.

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