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Application of Constructive Systems of Living Nature in Furniture Design

Madaminova M. X.
1-course PhD, Department of Industrial Design, Tashkent State Technical University, Uzbekistan, Tashkent

Abstract: This article discusses different types of structural systems, such as mesh, lattice and ribbed systems. Changing the shape of natural structure in the form of lattice, mesh and ribbed systems and how they influence lighting fixtures design. Examples of various types of structural systems in nature and in lighting fixtures are given.

Keywords: bionics, living systems, structural systems, ribbed systems, lattice systems, mesh systems.

Nature is a brilliant designer, engineer, artist and great builder. Any creation of nature is a highly perfected work, distinguished by amazing expediency, reliability, durability, economy of construction material consumption with a variety of forms and designs.

Forms in nature are perfectly formed, therefore the search for harmony in bionic shaping should begin with the maximum use of their strength and stability – bionic constructive systems.

Bionics and the resulting bionic design method represent the unity of technology and nature, combining functionality and aesthetics. Nature is the main source of inspiration, its mechanisms have been working for five thousand years. Observation of living organisms, studying their structure and construction, allows us to collect information bit by bit, and bionics allows us to apply this information in technology and design.

The bionic design method has recently become increasingly popular, and it is not only about the aesthetic component. Any product created using this method combines the following qualities:

- flexibility
- strength
- ability to move the center of gravity (say, from the center to any desired location)
- presence of hollow sections
- lightness (due to the previous point)
- relative thinness of the walls

If we talk about lighting fixture design, we understand that utility is function, durability is construction, and beauty is an emotional response. These are the three foundations, the three components of any design.

Living systems are an example of structures that function based on the principles of ensuring optimal reliability, forming an optimal form while saving energy and materials. These are the principles that form the basis of bionics.

In design, bionics has taken the position of a promising direction thanks to the universal category of language, the specificity of which consists of an organic combination of design-technical and figurative principles, which was noted in the developments of Yu. S. Lebedev "Architectural Bionics".

The issues of bionic patterns in design and architecture were reflected in the works of N.V. Zhdanov, A.V. Skvortsov, I.A. Cherniychuk. Many researchers were engaged in the harmonization of environmental design objects and the natural environment, including Shentsova O.M., Kazaneva E.K., Zherdev E.V. In the work of E.N. Lazarev “Bionic principles of architectural analysis and modeling of the vital activity of biological systems and their elements”.

In nature, there are mesh, ribbed and latticed structural systems. Analogues of mesh systems in nature are wide leaves of plants, wings of butterflies, dragonflies and other insects.

Lattice systems in nature are found in the internal structure of flat bones of animals and birds, in the cranium of humans and animals, in the poppy seed capsule, etc., and represent a combination of mutually intersecting elements. Ribbed systems - can have an analogy in the structure of the chest of humans, animals and birds.

The useful qualities of the systems under consideration are lightness, strength, resistance to mechanical impact.

Mesh, ribbed and lattice systems have found wide application in architecture and design.

Flat and spatially curved ribbed, mesh and cross (lattice) structures, in which the main material is concentrated along the lines of the main stresses, are widely distributed in nature. A thin leaf of a plant or a transparent wing of an insect have sufficient mechanical strength due to the branching network of veins in them.

This frame performs the main - supporting - role, while other structural elements, such as the sheet film or the wing membrane, can reach a minimum cross-section.

An excellent solution is to use perforation to reduce the weight of individual structures. Very common at present are projects with individual elements of bionics - lighting fixtures that repeat the structure of the body, the structure of plants and other elements of living nature, organic inserts, decor made of natural materials.

A characteristic feature of mesh and ribbed structures of frame systems is the distribution of functions between the load-bearing and supported (enclosing) elements of natural forms (leaf ribs, human and animal rib cages).

The most durable material in this case is concentrated on the lines of the main stresses, forming grids, ribs, lattices. They can be located in rectilinear or curvilinear curved planes and have insignificant ratios of the cross-section and linear dimensions of the planes they form.

Lattice systems can be thought of as a combination of mutually intersecting trusses. With the help of frame structures, the shapes of lighting fixtures were able to develop in space in all directions.

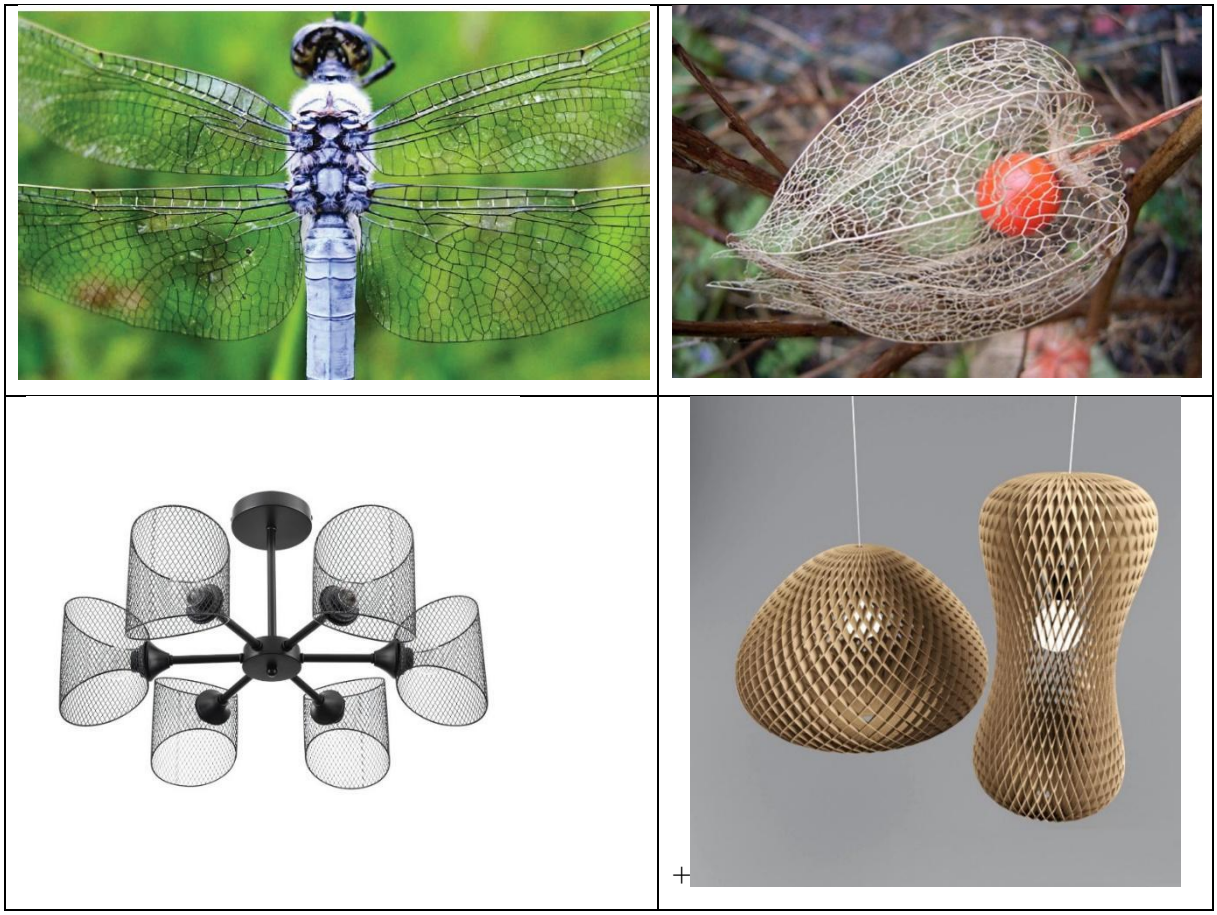

Fig. 1. The use of mesh structures in nature and in lighting design

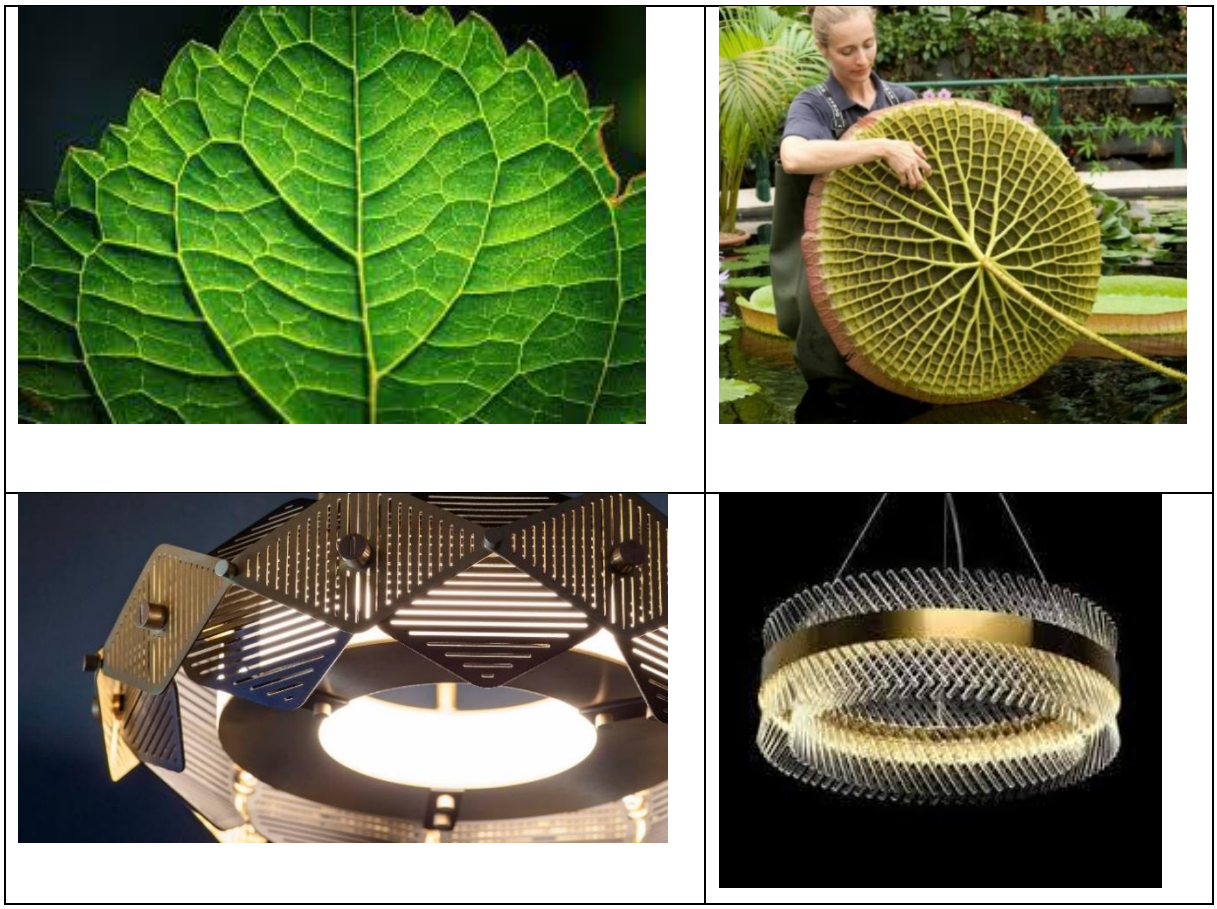

Fig. 2. The use of lattice structures in nature and in lighting design

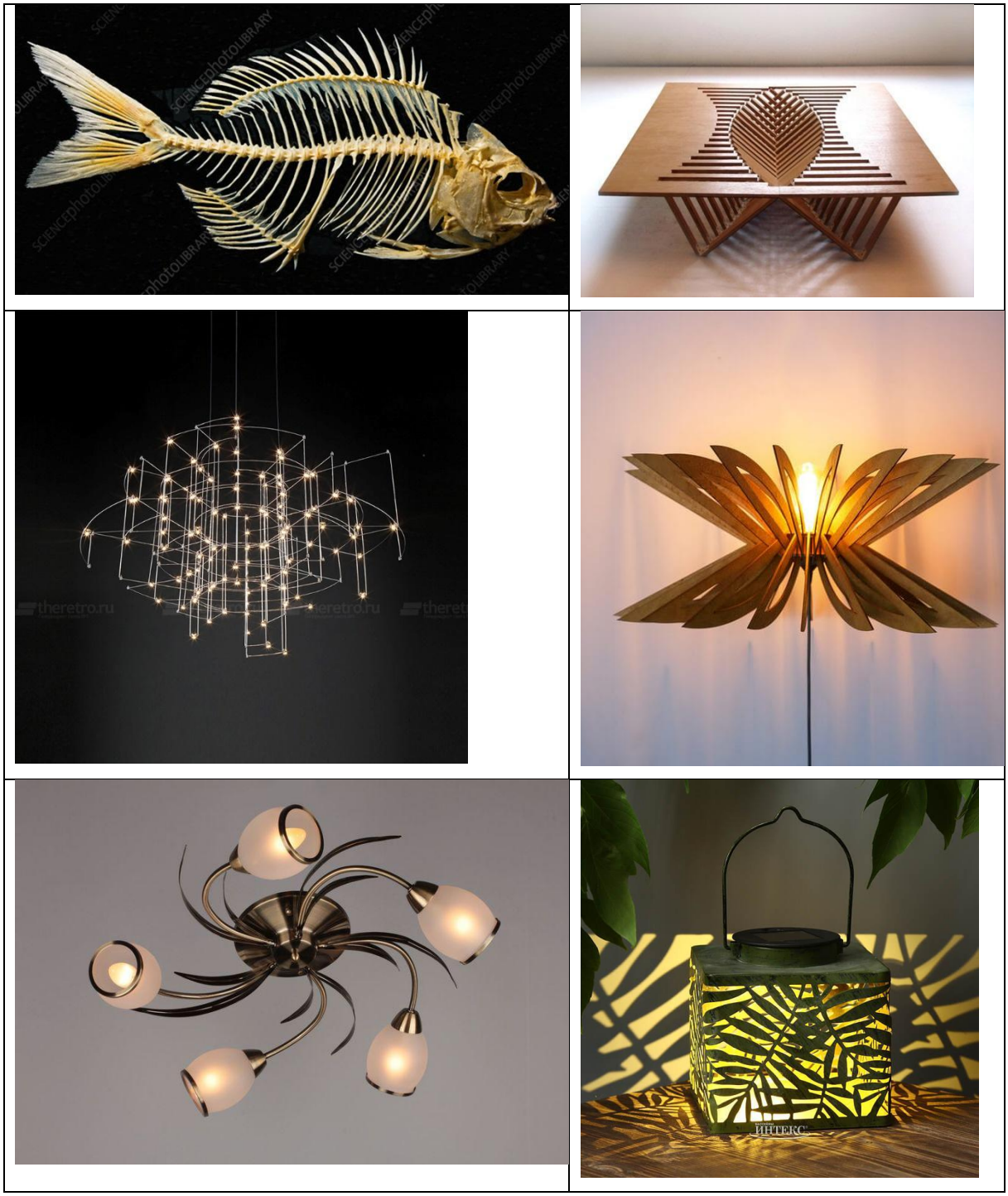

Fig. 3. The use of ribbed structures in nature and in the design of lighting fixtures

An excellent solution is to use perforation to reduce the weight of individual structures. Porous bone structures are often used to create interesting lighting fixtures, while saving material, creating the illusion of airiness and lightness. When creating a lighting fixture design, it is important to maintain the rigidity of the structure, significantly reducing the weight.

Designers draw their ideas from familiar structures of living nature, for example, wax and honeycombs - the basis for creating unusual structures in the interior: walls and partitions, furniture elements, decor, glass structures, lighting fixtures, elements of wall and ceiling panels, window openings, etc. Spider web is an unusually light and economical mesh material. Often used as a basis in the design of partitions, furniture and lighting fixtures, hammocks.

From all this work, we can conclude that structural elements play an important and significant role in the design of lighting fixtures. Without them, the existence of many plants and animals would be impossible.

Also, without knowledge of such systems, people would not be able to reproduce this beauty in architecture, landscape design, furniture, lighting design and any other activity.

A characteristic feature of the systems under consideration is the structure of spatial lattices, as if reflecting the general principle of the structure of the material world.

The subject of bionics is the study of the principles of constructing the functioning of living systems for the creation of technical objects. Bionics is an innovative direction in the design of artificial objects, taking all the best from nature: reliefs, contours, principles of shaping and interaction with the surrounding world.

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