

# Innovative Design Exploration based on Traditional Mortise and Tenon Structure

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**Abstract.** Mortise and tenon structure are a splendid national treasure of ancient Chinese traditional skills, which has been developed for over a thousand years. As the peak of the traditional production process and technology of China, mortise and tenon joint structure is based on the structure of the timber frame structure as the main way, between each component connected nodes in the concave and convex combination way and form, its originated in construction, widely in furniture, the mechanization and mass production today, mortise and tenon joint structure due to a lack of innovation, process trivial, low machining efficiency, by manufacturers in the cold gradually, this article mainly embarks from the structure of decorative design concept, through analyzing the application of modern mortise and tenon joint structure, puts forward the structure of the decorative design principles, providing a new method for modernization of mortise and tenon joint structure.

**Keywords:** Mortise and tenon joint structure; Innovative; Design.

## 1. Introduction

Tenon and tenon structure is the essence of Chinese traditional architecture and furniture. A basic structural principle can generate various changes, which reflects the wisdom and philosophy of the ancient Chinese. Today's mortise and tenon structure is not limited to the category of traditional furniture, designers at home and abroad are exploring its infinite possibilities. This will inevitably bring new opportunities for the inheritance and innovation of Chinese culture.

## 2. Organization of the Text

### 2.1 Characteristics of Tenon and Tenon Structure

In ancient Chinese architecture, furniture and other wood products, mortise and tenon structures are widely used. It is understood that the tenon and tenon components connection technology is very clever, the form is also various, the connection strength is quite big, is very durable. Mortise and tenon depend on the diversity form of oneself, achieve up and down, left and right sides, incline, bend etc. Of many azimuth seamless connection, make furniture maintains firm, solid posture, craft is exquisite. The tenon and tenon joint is a kind of concave and convex joint mode used in two wood components. Protruding parts are called tenons (or tenons); The concave part is called a tenon (or mortise, tenon groove), tenon and tenon bite, play the role of connection. This is the main structure of ancient Chinese buildings, furniture and other wooden instruments. Mortise and tenon structure is the combination of tenon and tenon, which is a clever combination of more and less wood, high and low, long and short. The basic mortise and tenon structure consists of two components, the mortise of one is inserted into the mortise of the other, so that the two components are connected and fixed. The part of the mortise that goes into the mortise is called the tenon, and the rest is called the tenon shoulder.

### 2.2 The Difficulty of Applying Traditional Tenon and Tenon Structure in Modern Furniture Design

Influenced by industrialization, mortise and tenon joint structure was once faded from the public eye, but with the localization of boom set off again, the designers began to carry out the traditional mortise and tenon joint structure can be incorporated into the modern furniture of bold practice, Taiwan designers hong Darrell "soft" series of furniture, Danish architect Hans wiener "chair" in

China, etc., are all very successful case. But the application of mortise and tenon structure in modern household field still has a variety of problems. For example, some furniture enterprises just imitate the ancient furniture in a hard way, and even simplify the mortise and tenon structure for the pursuit of interests, adding the amount of glue, gun nail has also become a common way of connection between components, seriously destroyed the original furniture set culture, science, ecology, aesthetic in one of the deep connotation. Still have a problem is, because craft is complex, choose material to be limited, make cycle is long, the contemporary household that blends into mortise and tenon structure sells price to be higher commonly, exceeded the bear scope of common masses, increased difficulty for extensive promotion. The traditional mortise and tenon tenon structure is not only difficult to develop, but also gradually fades out of people's sight due to various problems of technology, production, inheritance, material selection and price.

### **2.3 The Inheritance and Innovation Design Method of Tenon - Tenon Structure**

Now, we mention the mortise and tenon, it is no longer a simple structural form, connecting parts, it has been given the label of The Times, representing the millennium heritage and design essence of Chinese traditional wood handicraft. Mortise and tenon tenon has become an element symbol representing Chinese culture. In modern design, mortise and tenon can be used as a decorative element symbol in modern design.

#### **2.3.1 Innovative Design from Modeling**

The tenon and tenon structure is precise, the principle is simple, the pattern is multivariate. According to incomplete statistics, there are nearly 100 kinds of mortise and tenon combined with Ming furniture, such as cast Angle tenon, dovetail tenon, shoulder tenon, supporting Angle tenon, grid Angle tenon, chuck tenon, fence tenon, longfeng tenon, hold shoulder tenon. Combination form of various forms, provides a more contemporary household designers see sample, these structures can need according to the design, direct or indirect reference to the design, by its shape according to the structural connection requirements to design, to abandon the connection of the thinking inertia of industrialization, less flashy design, pay attention to the classic designs. Mortise and tenon structure is different from welding, bonding and so on, it can be completed by different occlusal ways to close the connection of each member, so that it becomes a whole. In the design in contemporary furniture, stylist moves mode of traditional mortise and tenon to join, refine classics, transform innovation, create the work that gives more to have design feeling and historical feeling, let ancient craft be born again in contemporary household environment.

#### **2.3.2 Innovative Design from Modularity**

The tenon - tenon structure embodies a modular design method. Modern product design. Not only must have the use function, but also has from the appearance form, the standardization production, the user participation interaction, the packing transportation and so on the synthesis consideration, the standard interface design. It is not only convenient for standardized production, but also allows free assembly among various components, so that the product has a variety of combination forms and functional changes, enriching the sense of form of the product. It is through the decomposition and combination of components to express the form of diversification. In case of damage, it is convenient to replace the parts, and the detachable feature also facilitates the transportation of large furniture. People can also mix and match new products according to their own needs at will to meet functional needs and personal aesthetic needs, to achieve personalized needs.

#### **2.3.3 Innovative Design from Materials**

Traditional hardwood furniture is much selection of quality of mortise and tenon joint structure, wood texture clear, beautiful color texture, making provides a good foundation for the construction of mortise and tenon joint conditions, but in today's modern industrialized, mortise and tenon joint structure of the furniture also can be used in the design of new materials to develop design, gradually replace traditional annatto material. Such as acrylic, alloy, metal and other artificial

composite new materials. Through can reasonable use of new materials to solve some disadvantages of the traditional annatto mortise and tenon joint structure, for example, when designing a little modelling using mortise and tenon joint structure, because the structure is too small, the wood can not meet the standards would fracture mechanics, by this time the traditional wood mortise and tenon joint structure with some mechanical properties of new materials to replace, can not only solve the problems existing in the traditional mortise and tenon joint structure, so as to realize the design of mortise and tenon joint structure, and optimize its performance.

#### **2.3.4 Innovative Design from Manufacturing Process**

The research, development and application of new technology and new technology seek a new way for the inheritance of classics. Traditional mortise and tenon joint structure is given priority to with manual, this traditional handicraft techniques are no longer adapt to the modern furniture manufacturing, unable to meet the requirements of production in large quantities, so the application of new technology is very important, modern mortise and tenon joint structure of the processing should be given priority to mechanization, the introduction of foreign advanced equipment, the improvement of domestic machinery and equipment, use of information technology and automation technology, the use of 3 d printing to do auxiliary processing, on the basis of the traditional use of innovation with the new processing technology and the reasonable application of new technology, for the development of the design of modern furniture of mortise and tenon joint structure has a very important role, Can improve the competitiveness of the market.

#### **2.3.5 From the Decorative Start of Innovative Design**

On the premise that the design of traditional mortise and tenon structure conforms to the function and structure, the exploration of decorative design can be carried out. Integrating practicability and aesthetics, this feature can be used in the design of modern furniture, to reflect the design of the window, breaking the traditional mortise and tenon joint structure built-in form, its exposed, fully considering the structure of mortise and tenon joint trace, in this new way of structure to highlight visual aesthetic value of explicit structure, mortise and tenon joint structure of the functional and decorative beauty, in the show at the same time, to express the beauty of structure and mortise and tenon joint inherent mechanics principle, structure and form to achieve the perfect unification, the charm of mortise and tenon joint of the full performance

### **3. Summary**

The mortise and tenon structure is extracted from the profound historical and cultural background, and its simple concise-convex relationship surpasses the achievement of the practical essence, but also embodies the history, culture and traditional skills most vividly. The construction, separation and wedging of tenons and tenons is the embodiment of tradition and modernity, inheritance and innovation, bearing profound design designer and cultural connotation. Today, when the furniture industry is booming, it is transitioning from "traditional design" to "modern design". At this time, reviewing the essence of traditional creation and drawing design inspiration from it, its significance is not only to inherit the tradition, but also to guide the future. Designers want to mind their respect to the ancient skills, have the responsibility and mission in the modern furniture design, the traditional mortise and tenon joint structure, reasonable improvement and innovation, combined with modular furniture design, using the modern material combination, highlights its adornment sex, fully embody the expansibility of mortise and tenon joint structure, make it more adapt to the modern manufacturing technology, aesthetic idea and way of life. The traditional mortise and tenon structures should not only belong to the protected intangible cultural heritage displayed in museums, but should be returned to the modern furniture works, which are familiar to more modern people. Continuing the essence of traditional creation, creating new furniture works to promote the development and innovation of modern furniture design. In this way, the "new era" spirit of integrating traditional culture with modern design aesthetics can be realized,

so that the traditional craft can have a long history and get high-quality inheritance and development.

## **References**

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