

Based on the Influence of Standard parts Installation and Surface Quality on Aircraft Assembly

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ABSTRACT: In the process of aircraft assembly, various parts have an important impact on the aircraft assembly, among which the fasteners play an important role in the aircraft assembly, affecting the stability of the aircraft assembly and the service life of the aircraft. Standardized fastener installation and surface quality affect the aircraft assembly quality. Proper fastener installation and guaranteed quality are conducive to reducing the risk of aircraft assembly. However, the characteristics of standard fasteners in aircraft assembly need to be studied urgently. This paper analyzes the assembly characteristics of aircraft standard parts, the information and constraints of standard parts, discusses the assembly information of standard parts, and explores the types and installation requirements of fasteners, hoping to improve the assembly effect of standard parts in aircraft assembly.

1 Introduction

Standard parts can refer to a variety of aircraft assembly parts, refers to the aircraft commonly used parts in the structure setting, size setting and marking aspects of standardized design, and unified in accordance with the professional production department production. Parts commonly used in aircraft assembly are threaded parts and keys. And can be standardized production of mechanical parts are very large, common components are fasteners, transmission parts and hydraulic components. Among all mechanical parts, standard fasteners are the most representative feature and are the most frequently used in aircraft manufacturing. Therefore, by analyzing the assembly characteristics of standard parts and standard parts information and constraints creation prevention, this paper will take fasteners as the research focus and explore the impact of their installation and surface quality on aircraft assembly.

2 Research on the assembly characteristics of aircraft standard parts

2.1 Assembly characteristics analysis

Assembly features belong to an intuitive information that can be used to express the assembly relationship between the standard parts and the standard parts, where the assembly features belong to a vector. When the standard

parts are used in the assembly process of the aircraft, the standard part is a combination with multiple assembly characteristics. A complete aircraft assembly is a combination of multiple standard parts according to certain assembly characteristics and relations [1]. The integration of aircraft assembly characteristics and the assembly design changes the operation object of the assembly design, transforming from the operation underlying elements to the assembly characteristics, packaging the standard parts and assembly-related attributes, to help the future assembly design, and assigning each standard part to the assembly design. Providing designers with the opportunity to implement assembly design at the assembly level to fully meet the needs of rapid assembly. Aircraft assembly has engineering significance, and the standard fasteners are used to tighten the mechanical parts used in the connection, and the assembly has a certain constraint relationship between them, which is a collection of geometric elements. Assembly takes geometric characteristics as a carrier to fully convey the assembly constraints between parts and parts. In the assembly process, the standard parts need a platform that can operate quickly. In the design process, the standard parts need to be quickly selected and called. The assembly design system created by the standard parts is used as the basic data platform in the assembly process, and the overall framework of the aircraft assembly system is shown in Figure 1. It is divided into three levels, among which interaction layer is used for communication, application layer is used to realize the main functions and support layer as the system application guarantee.

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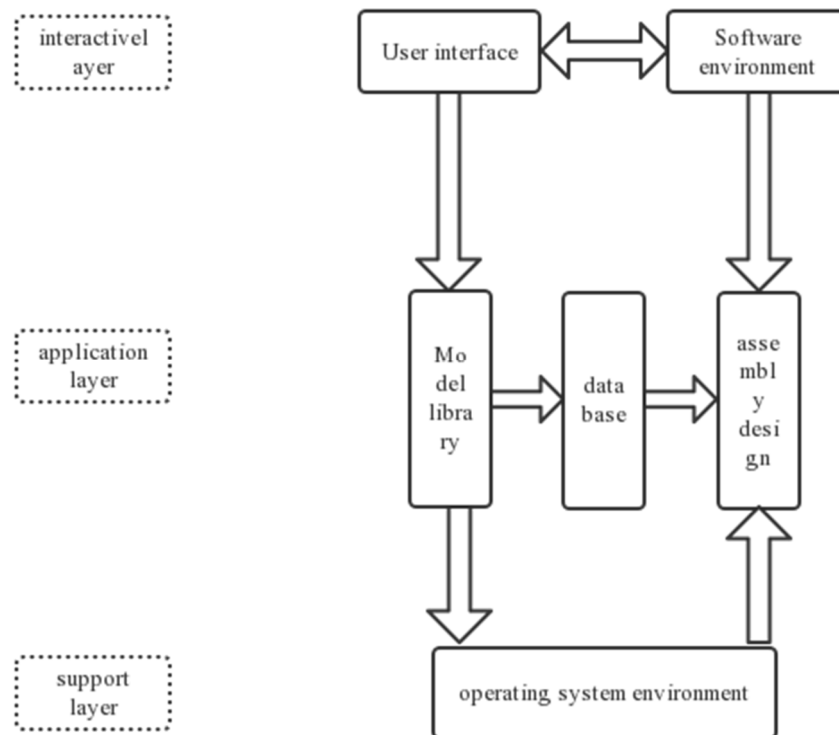


Figure 1 Aircraft standard parts assembly design framework

3 Create standard parts information and constraint methods

3.1 Standard parts information

As the basis of the design, the standard parts information plays an important role in the design process, and the information needs to be obtained before developing the assembly design. Information needs time to accumulate, accumulation and precipitation in continuous practice. Standard parts information is related to the basic information of the standard parts, such as the size, assembly, and configuration information of the standard parts. Analysis the standard parts according to the assembly function information[2].

3.2 Standard parts model information

Standard parts model information is related to the assembly model and the size information of the different series, With the geometric model material information, according to the similar characteristics of the standard parts geometric model, designing it in a more advanced way, focusing on the quality of the standard parts. Constraint the size features of the other standard parts according to the collection model features of the standard parts, with room for modification, relevant designers can update the standard parts according to the size of the standard parts, for example, the bolt design, when the

diameter and the nominal length of the part have been determined, the remaining parameters can be determined according to the bolt model dimensions, the assembly information frame information can be represented by this formula (1):

$$S = \{C_{i|j} = 1, 2, \dots, 169\} \quad (1)$$

3.3 Assembly information of the standard parts

Assembly information of standard parts is closely related to assembly design. In assembly design, standard parts and so on. Installation and quality have a great impact on the aircraft assembly. Therefore, in the assembly design process, the relevant standard parts need to be loaded, and a certain constraint relationship between the associated standard parts will be established to improve the overall assembly effect of the aircraft. In the assembly process, the standard parts can be constrained by two features, such as axis features and surface features. Assembly characteristics define the various components between the assemblies. In the modeling process, the standard parts assembly constraint is the limitation of the position of the standard parts. Different relational constraints successfully realize the freedom of the assembly parts and locate the assembly parts successfully[3]. The assembly characteristic of the standard part has a certain relationship with its assembly constraint type. The assembly characteristic is that the surface and its assembly relationship is the contact. When the surface quality of the standard part is poor and used as the surface in the

assembly feature, the contact effect in the assembly relationship will be poor. Assembly characteristics and assembly constraints are shown in Table 1.

Table 1. Assembly characteristics and assembly constraints of standard parts

| Assembly features | code name | Assembly relationship |
|-------------------|------------------|-----------------------|
| Face | contactFace | touch |
| Face | coincidenceFace | coplane |
| Face | OffsetFace | shifting |
| Line | contactAxis | touch |
| Line | ConincidenceAxis | collineation |
| Line | OffsetAxis | shifting |

4 Impact of standard parts installation and surface quality on aircraft assembly

In aircraft mechanical parts, although fasteners are basic parts, they are highly versatile and serialized, which can be widely used in aircraft manufacturing, and can achieve a large number of repetitive use. During the aircraft assembly process, the installation quality of the fasteners has a significant impact on the structural strength of the aircraft equipment. China strictly controls the quality of fasteners, carries out research on the product size and performance, and controls the product quality of fasteners according to the requirements of standard parts[4]. Fasteners can be used to connect the other parts and components of the aircraft, which can withstand the force transmitted from the part hole. Most of the fatigue damage of the aircraft occurs in the connection parts of the body. Therefore, it is of great significance to study the standard fasteners to ensure the assembly quality of the aircraft. This paper takes the installed head standard fasteners as the main research object, analyzes the types and installation requirements, and studies the impact of the installation process and quality on the aircraft assembly.

4.1 Type of installed head fasteners

Current assembly type in the world is given priority to with five types, including the main bolts, nails, and the main size of the installed head fastener including head Angle, height and large diameter, in the process of assembly, need assembly according to the actual situation, such as head Angle difference, head diameter is different need for different head large diameter tolerance socket.

4.2 Installed capacity requirements of standard countersunk fasteners

When the standard fasteners are installed on the skin, it should be arranged with the skin and the rivet head cannot be removed on the mouth cover. When the buried screw head is tilted, the raised and depressed central wing and

tail limit are depressed, for example, when the depression and bulge of the wing and tail are not greater than 0.1mm, then the single bulge and depression of the buried screw should not exceed 0.15mm. The bulge and depression on the core part of the aircraft and the inlet should not be greater than 0.2mm. When the sunk screw with a large curvature appears, the bulge and depression of the single surface should not exceed 0.3mm. Each row of head bolt and its high shear rivets on the aircraft head needs to be reasonably controlled, and generally does not exceed 10% of the total. At the same time, the single surface gap between the nail head and the base hole should not exceed 0.2mm, and it should be less than one-third of the circumference of the nail head.

4.3 Analysis of standard fastener installation problems

The installation and surface quality of fasteners will affect the service life of the aircraft, among which the strength and fatigue resistance of fasteners are very important. If the installation process is poor, it is easy to affect the assembly of fasteners. Some aircraft structure problems may be related to its thin-wall structure, the fatigue crack of the thin-walled structure and the stability of the assembled fasteners is reduced, began to loosen the phenomenon, or even fall off is a common fault in the aircraft structure. Fasteners play an important role in the aircraft assembly. The fastener failure will seriously affect the use and maintenance of the aircraft. When the aircraft is flying at high altitude, or during take-off or landing, its thin-wall structure will be subjected to large forces, bearing different loads, such as alternating and vibration load, so the thin walls of the aircraft are prone to fatigue problems[5]. Fastener failure may be due to the vibration load, leading to loosening, shedding problems, and even has reached the fatigue limit, causing fracture. Under the same load, the fastener connected by the user is prone to yield deformation, whose occurrence probability exceeds the probability of fatigue fracture, so the vibration load is the main reason for the loosening of the fastener. When selecting aircraft fasteners, it should be selected according to certain standard system, and the standard system of fasteners should be proved in the aircraft verification, so the credibility is extremely high. Extending the connection life of the standard fasteners should be combined with the fasteners and part assembly conditions.

For example, in the actual case of aircraft assembly of a company, the aircraft sink fasteners are abnormal in the installation process. According to the actual situation on the site, the abnormal performance is the nest leakage problem. Therefore, it is necessary to connect the fastener manufacturer according to the actual situation, and implement the assembly again, which affects the assembly progress of the fasteners. When the fastener bolt tolerance and socket tolerance will occur in the installation process, such as head height, sink Angle and head diameter of three dimensions, the field assembly test, select the fastener better assembly factory product mapping and analysis method, and the main reason of the head size of the fastener, if the fastener head is too large, also easy to cause

assembly leakage[6]. There is a large discrete nature in the same batch of products produced by the manufacturer, the discrete type is related to the head size, the head height, the smaller the height, the smaller the dispersion is. Therefore, the fastener products should have a high joint with the sink head socket.

4.4 Installation process and improvement measures of standard fasteners

Continuing to optimize the mold parameters of the standard fasteners, introducing new mold production, constantly rectify according to the specific problems of the product, and changing the facial size of the cross groove Yang mold arc reasonably, controlling the thickness of the outer circular tip edge, and passing the scientific assembly test, the trial installation is successfully completed, in line with the needs of on-site installation. And improving the installation documents, reasonable control tip edge thickness, the minimum of the outer circle diameter of the minimum, but the lack of tip edge thickness, so although can meet the relevant standards, but the bolt head and the assembly hole fitting degree has great influence, when repeated tests, finally reasonable control tip edge thickness in 0.3mm, improving the installation effect of fasteners. At the same time, typical standard samples were successfully made for trial installation. Meet the needs of the site. So in order to improve the assembly process effect need to strengthen the management of standard parts, adopting standard specialized production organization, forming a set of standard standard parts control system, avoiding affecting the surface quality of standard parts, in the process of installation in order to prevent mixed installation, should be installed in accordance with the relevant requirements, in order to improve the quality of installed.

5 Conclusion

The assembly quality of the aircraft is closely related to the service life of the aircraft. In order to ensure the quality of the products, it is necessary to strictly control the installation and surface quality of the standard parts. During the installation process, it is assembled in strict accordance with the standard system and installed in batches to improve the assembly effect. In the case analysis of this paper, we take the fastener assembly as the research object, and summarize that the fastener assembly should pay attention to its loosening and shedding problems, pay attention to its standard consideration, improve its installation process, and provide a guarantee for the body stability.

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