

Research on Virtual Assembly Technology in the Field of Wind Power

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Abstract

In the field of wind power, the installation is complicated and there are many parts. Due to the particularity of the structure, it is a heavy and difficult task to assemble a single machine from a single part. Wrong assembly or unskilled assembly will affect the quality and service life of the wind turbine, and its assembly performance directly affects the development cost and cycle of the wind turbine. Therefore, it is necessary to carry out virtual assembly of wind turbines in the design stage to help comprehensive and accurate inspection and analysis of product assembly problems to verify the correctness of assembly design and operation, and early discovery of the design and assembly process Possible problems and then modify the wind turbine model, thereby reducing costs and shortening the development cycle. This article mainly analyzes the current status of virtual assembly technology, outlines the classification of virtual assembly technology and the technologies involved, and takes the gearbox assembly of virtual wind turbines as an example to introduce UG and EON soft in the virtual assembly modeling of wind turbine gearbox Applications.

Keywords

Wind power, Virtual assembly, Gearbox assembly, UG, EON.

1. Introduction

Compared with the gear transmission of other mechanical systems, the wind power gearbox transmission system is more complicated. There are many parts in the group, and its assembly is a complicated project. Moreover, the processing requirements are very strict. Whether the design is reasonable or not will directly affect the operation of the wind turbine. In order to improve the efficiency of assembly work and reduce assembly costs [1]. Virtual assembly came into being.

This article uses the virtual environment EON to build the environment. EON studio is a GUI-based design tool. You can easily import various 3D models, and then add various behaviors to the model for production simulation, assembly disassembly function operation simulation, etc. It establishes a virtual assembly environment on the computer, and the assembly personnel use the means of virtual reality [2]. Carry out various assembly operations in a natural and conscious manner, help designers verify potential assembly design problems (such as component interference, assembly collisions, etc.) and feedback to designers to modify the model, thereby ensuring product quality and reducing costs.

2. Status and Classification of Virtual Assembly Technology

2.1 Development Status of Virtual Assembly Technology

An important part of virtual manufacturing is virtual assembly technology. Compared with other parts of virtual manufacturing, virtual assembly technology performs weaker. The lagging development makes the application of virtual assembly technology in society still not very common. Based on this, the development of virtual assembly technology has become an extremely important topic and task of today's virtual manufacturing technology, which helps to improve the virtual manufacturing

technology and make it a complete theoretical system, which has both high efficiency, short-term and low cost. In addition to its own quality service.

2.2 Classification of Virtual Assembly.

The current virtual assembly research can be divided into three categories according to its function and purpose, namely, virtual assembly centered on product design, virtual assembly centered on process planning and virtual assembly centered on virtual prototype.

In the process of mechanical product design, virtual assembly can more effectively assist designers in making design decisions related to mechanical assembly. Generally, computer simulation methods can be used in a virtual environment to achieve mechanical assembly assisted design. Virtual assembly is mainly oriented to assembly design theory and methods [3]. The main problem to be solved is to find the optimal solution in mechanical assembly based on existing principles and schemes, combined with various constraints in reality, thereby determining the assembly sketch.

In the assembly process of mechanical products, the most important foundation is the information model and assembly resource model of mechanical products, which uses simulation technology and virtual technology to design and simulate mechanical product assembly. In this way, a better process plan is obtained to provide guidance for the actual assembly work. In actual work, according to the scope and level of assembly, it is subdivided into system-level and job-level assembly planning. System-level assembly planning is an overall plan for assembly production, including market demand, investment status, production scale, production cycle, resource allocation, assembly workshop layout, and assembly line balance. It can be used as a framework document for mechanical assembly work; job level Assembly planning focuses on the planning of the mechanical assembly process, which generally includes the planning of assembly sequence, assembly path and process route. Taking process planning as a virtual assembly center is characterized by a high degree of consistency in operation simulation [4]. The main aspects reflected are the assembly objects, assembly process and tools used during the period are similar to the actual height. Therefore, it can intuitively reflect the actual assembly process of mechanical products, and the simulation results have a high degree of credibility.

3. Technical Analysis of Virtual Assembly

3.1 Product-centric Assembly Modeling Technology

Virtual assembly modeling of mechanical products is an important part of assembly design. The essence of modeling is to establish a close relationship between computer memory and external performance. The quality of the model established in the early stage is directly related to the effectiveness of the subsequent work of the virtual assembly system. Therefore, it is very important to establish a complete and highly unified mechanical assembly system model. The most typical assembly model is the binary tree model. The most intuitive feature of this model is to treat the assembly as a binary tree, the assembly that the user ultimately needs as the root node of the tree, and the non-leaf node as the sub-assembly of the assembly system Generally composed of many parts and sub-assemblies, each part is represented as the lowest-level leaf node in the model. Each leaf node can lead to many non-leaf nodes, indicating that each part in the system can be referenced multiple times in the assembly.

3.2 Assembly Sequence Planning Strategy

In the process of assembling mechanical products, the most important point is the installation order of parts and sub-assemblies. The same mechanical products can use a variety of different assembly sequences; different assembly sequences in turn produce different assembly sequences. When assembling, it only needs to follow a specific assembly sequence to successfully organize the assembly work, and it is the mechanical assembly that can meet the final design requirements. It is undeniable that there will still be some assembly sequences that are difficult to achieve the expected assembly target for various reasons.

3.3 Virtual Assembly Simulation Technology.

The application of this technology is mainly to check the coordination and ease of installation between mechanical parts in the design stage, which greatly improves the accuracy of mechanical design. Simulation technology can support people to browse products digitally, verify the sequence and path of mechanical assembly planning, evaluate product assembly, and obtain feedback information by relying on assembly procedures, so that designers can quickly adjust designs and further improve the quality of mechanical design.

4. Application Examples of Gearbox Assembly

4.1 Software Introduction

UG is the most widely used large-scale software in the world that integrates first-class computer-aided design, auxiliary manufacturing and auxiliary engineering (CAD / CAM / CAE). It is one of the most complete product design tools on the market and is widely used in machinery, Aviation, mold and other industries product design and manufacturing.

EON Studio is a GUI-based design tool that can easily import various 3D models and add various behaviors to the model for production simulation, assembly disassembly function operation simulation, etc. It makes up for the large size of CAD files on the Internet, which cannot be transmitted in real time and cannot control the simulated product functions in real time; it can be combined with multimedia such as Mieromedia Director to form an electronic catalog or website to help marketing; you can also use this tool to The assembler conducts operation training. Its control interface is the most affinity among all VR software. By dragging it, the complex programs of VRML in the past can be solved in a few seconds. More than one hundred kinds of functional nodes (Nodes), simulation tree (Simulation Tree) and behavior control (Routes) that have been used through tens of thousands of tests in the past have made it easy for current users to build complex VR surroundings.

4.2 Building Environment Model

In order to facilitate the subsequent optimization and import into the virtual reality software EON for quick analysis, the parts of the gear box shell, planetary gears, frame, helical gears and shafts are drawn in sequence in the UG. Only the shell, planetary gears, main parts of the frame, helical gears and shafts that play the role of transmission are built, and bearings and bolts are omitted. After completing the modeling of each part, then enter the assembly module, according to the alignment relationship of matching, matching, center and other assembling in order to complete the assembly of the gearbox.

4.3 Virtual Assembly

Import the parts and their related assemblies designed in UG into the EON for virtual analysis. It is acceptable to convert the file into EON. igs format, in order to use EON's data conversion interface to import the solid model built in UG into the virtual assembly environment.

EON can read files in X, ppm, png, wav, avi, and midi formats. When files are imported, EON converts the original format of these files to a format compatible with EON and creates a logical hierarchy in the EON database. Open EON, first drag the frame node from the node window to the frame scene node in the analog window, rename it to gear box, select this node, select file -> Import, and then select .igs file format option, use its own data conversion interface to import the built assembly solid model into the virtual assembly environment. In this way, the gearbox assembly created in UG is introduced to EON. In the virtual assembly process, the engineering-level transmission system parameters such as bearing selection and gear manufacturing accuracy grade, roughness and backlash are selected, complete the mechanical transmission system kinematics and dynamics simulation analysis, check the shaft and bearing stiffness For the influence of gear misalignment, bearing life, etc., learn and master the analysis of performance parameters such as oil temperature, oil film thickness change, bearing life, meshing misalignment, contact spot, transmission error, which are not easy to test in real experiments.

4.4 Principle Analysis.

Virtual assembly is a very important part of modern equipment manufacturing. Comprehensively consider the impact of assembly in the design stage, evaluate the assembly, disassembly and collision interference of the gearbox of the wind turbine, verify the correctness of the assembly design and process, and find the interference in the design and assembly process early And other issues [5].

Because disassembly and assembly are two opposite and unified aspects, on the premise of the basic assumption of "removable and ready to install", the assembly is regarded as the reverse process of disassembly, and the simulation method is used to try to disassemble the target assembly. Feasible disassembly process, and then obtain a reliable assembly process by inversion. The general idea and basic process of assembly planning by disassembly method are: select components and their disassembly directions in sequence, and the computer system will refine the components along the disassembly direction according to the user's choice and follow the given steps for detailed processing and gradually proceed The operation of changing its spatial position gradually disassembles the parts. The disassembly method is used to solve the assembly sequence of the product, which completely simulates the behavior of the operator in the actual assembly process [6]. Operators disassemble parts in a virtual environment according to assembly knowledge, experience and practice, and record the disassembly sequence of the product by the computer, thus avoiding some sequences that are theoretically feasible but have no engineering value, greatly reducing the time for assembly planning . The computer gradually displays the assembly sequence and path selected by the user at a given step size, and at the same time performs certain reasonableness tests, such as real-time interference test, so that the user can review the rationality of the selected result from a visual perspective And feasibility, so that users can further choose and adjust.

5. Conclusion

In this paper, the gearbox of the wind turbine is used as an example to build, and the virtual assembly software EON is used for virtual assembly. Not only can the problems in the assembly be discovered early, the assembly model can be modified in time, but also the various assembly processes can be observed. Simulate assembly. It truly reflects the structure and relative position of each part of the gearbox, and determines the correct disassembly and assembly order, provides a virtual environment for mechanical disassembly and assembly training, and greatly saves training costs. Using this technology will greatly shorten the product development cycle, reduce costs, improve production efficiency and product quality. Virtual reality technology has gradually been applied to industrial production training, especially in high-tech industries. The role of virtual assembly technology is that other technologies cannot Comparable.

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