Research on Real-Time Interactive Technology Based on Remote Design of Computer Engineering Cad Products

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Abstract. Through the construction of "real-time like interaction" model, CAD remote products co-design real-time interaction. This paper first describes the remote design of CAD products for computer engineering, and briefly introduces the basic structure of real-time interaction of CAD remote product design class and STEC standard for CAD operation command exchange, to provide readers with reference.

Keywords: Computer Engineering, Cad Products, Interaction Technology, Nrti Distribution Structure

1. Introduction
In order to realize cross-platform exchange of information among CAD remote products, the server transmits relevant information to remote users in an event-driven/time-driven synchronous manner to achieve the effect of near-real-time information interaction [1-3]. In addition, there is no information operation command standard among heterogeneous CAD systems, which is the key and development direction to realize real-time interaction and sharing of CAD information [4-6].

2. Remote design real-time interaction technology for CAD products of computer engineering
At present, the real-time interaction is mainly carried out at two levels: one is the real-time interaction based on shared information and data standards, that is, the product information interaction level represented by STEP (CAD drawing is shown in Figure 1). Although the interaction at this level is simple in implementation and has good data consistency, it is difficult to reflect the design process information due to the large amount of interaction information, over-centralization and poor real-time performance. The other is the CSCW information interaction layer represented by the computer conferencing system and shared application tools (SAT). Real-time audio and video technology are widely used in computer conference system, and sharing application tools transmit sharing interface according to sharing whiteboard mechanism or dynamic display screen capture mechanism, to achieve real-time collaborative effect. The interaction effect at this level is good, but the interaction information is huge and the interaction group size is small, which cannot be realized in the Internet environment. Interactive real-time reflected the interaction level, in order to adapt to the needs of engineering product information in real-time, the authors on the analysis of the interactive information on the basis of the object, content and way, put forward a kind of real-time interaction model, its basic idea is based on the incremental information of CAD system as the main interactive content, based on...
event/time driven synchronously by Internet design objects and the process of real-time interaction. This approach forms a third level of real-time interaction: a level of semantic information interaction represented by CAD command manipulation information.

![CAD simple drawing](image)

**Figure 1.** CAD simple drawing.

3. Basic structure of real-time interaction of remote product design class

3.1. NRTI centralized structure

The single-user machine node where the initial shared information is located is called mNode as the master node, which is defined as mNode= < Id,Info,Bitmap,Process >, where Id is the identity of the master node. Info shares information for a single user; Bitmap is the output interface Bitmap of Info on the screen after Process.Process is an interactive service Process. The functions completed in accordance with the time sequence include: (a) Generate these events at local nodes according to the event data received from mouse and keyboard;(b) Bitmap output on the screen;(c) Store and transform Info;(d) Sending messages and data to the network;(e) Receiving messages and data from the network.

3.2. NRTI distribution structure

Distributed NRTI requires that copies of the respective shared information be run on all machines, and input from users with input rights is sent synchronously to a backup of the shared information on all machines. All operations on the computer that share information will give the same input and the same output to the user.

4. CAD operation command exchange standard STEC

4.1. STEC construction principle

The remarkable characteristic of NRTI is that it realizes the interaction on the semantic level of operation. At present, the interaction between CAD systems mainly takes file form as the carrier, lacking a common standard to standardize the definition of the set of operation commands to realize the same operation object and result between different CAD systems. However, when comparing different CAD systems, their operation commands are similar in terms of geometric modeling function, that is, the geometric model of products is established by using interactive graphics system to input commands that generate basic graphics elements. Their supporting software (including interactive graphics support system, engineering database and various high-level language compiler) also has a certain universality. Therefore, different CAD systems can be mapped to neutral operation commands. To this end, the authors propose a CAD STandard for the Exchange of oCommand in Computer Aided Design (STEC). Tectonic STEC's main goal is: to provide a strong expression of the CAD system for communication and sharing of order form, ensure that the processing and interpretation of the command language is easy to operation, easy to expand the function of the CAD communication and sharing, can effectively for remote CAD operation communication and interaction, easy to implement operation between different CAD system of object information transformation,
realize the whole process of sharing.
Aiming at the above objectives, the author proposed four principles of STEC construction:

1) The principle of simplicity and practicality. A key factor in whether STEC becomes a true CAD operation command exchange standard is whether STEC is similar to existing CAD system commands and is easy to convert. Given that engineering CAD software at home and abroad is dominated by AutoCAD and its secondary development system, the current STEC construction takes AutoCAD command as the reference object, and aims to simplify the command and make it practical. Firstly, STEC standard, namely the basic command construction of STEC, is realized in the engineering CAD interaction process.

2) Principle of function expansion. STEC is not just for engineering CAD. STEC’s goal is to become the future standard of CAD system commands for all. Simply extending the STEC standard does not solve the fundamental problem. Because STEC command expansion requires interactive CAD systems to have corresponding mapping commands, otherwise illegal operations will occur.

3) Operation environment initialization principle. Although the initial shared information for the full distribution is identical for each user, the CAD commands are executed in different operating environments because the CAD systems with which they interact are not the same. In the process of operation, it is bound to cause inconsistency in the operation result and content information between the transferor and the transferee, resulting in invalid interactive operation of CAD command.

4) Principle of authority control. NRTI requires the content of the initial shared information to be exactly the same, and the interactive CAD operating environment to be as unified as possible. However, from the perspective of collaborative trend, information objects have shared permissions, which is a key problem restricting the development of STEC in the future. It not only causes the inconsistency of initial shared information, but also makes STEC easy

Concurrence conflicts, and there is also the issue of STEC transmission and receiving permissions. Therefore, the permission identification in the STEC standard is very important. The permissions service behind the server is one of the solutions to realize STEC transmission and receiving permissions.

4.2. STEC construction method
STEC standard commands can be expressed as first-order predicates: P (A1, a2... an), where P is the sign of the predicate, and the predicate can be either an internal function or defined by the user. STEC has command(c1, C2... Command is a command function that consists of the English name of the operation object. STEC includes six basic commands: basic drawing, text input, graphic editing, dimensioning, 3D drawing, and property setting; Ci (I = 1, 2,... n) is a command parameter, which can be either a function selection or the data needed to execute the command. The data types include: distance or displacement, Angle, point coordinates and other geometric quantities; Simple numeric types such as integer and real number; Character information such as text, attribute values, size text, and file names.

The SLISP language can be described in the following meta-statement: Defun SCommand (arl ar2... Arn/v1v2... vn) e1e2... En, where deFun is a custom command function used to define the extension command beyond the basic STEC command; The first argument, scommand, is the name of the command function; The second parameter is a table in which arl(I =1,2... n) is the independent variable of the command function, vi(I =1,2... n) is a local variable; Parameter ei (I = 1, 2,... is an expression of any type, such as command(arl ar2... Arn), etc., constitute the definition body of the command function (Figure 2 SLISP language calculation process).
4.3. Results of STEC construction

The STEC command set implemented so far has a total of 41 items in six classes. The six STEC operation commands are: basic drawing, text input, graphic editing, dimensioning, 3D drawing, and property setting. Here are some examples of them (one for each type, for space only): Draw a LINE: LINE(PB,PE,LW), Where PB is the starting point, PE is the end point, and LW is the line width. Define text font: STYLE(TS,TH,TW,TA). Where TS is the text font name, TH is the text height, TW is the text width and TA is the text tilt Angle. COPY graph: COPY(SO,PB,PE), where SO is the selected entity, PB is the COPY base point, PE is the COPY target point. Parallel length annotation: ALIGNED(PB,PE, AL, AT), where PB is the first point of dimensioned is the second point of dimensional is the position point of dimension line, and AT is the content of dimension annotation. Cube drawing: BOX(PC,L,W,H,RA). Where PC is the first corner point of the cube, L is the length of the cube, W is the width of the cube, H is the height of the cube, RA is the Angle of the cube around the Z axis. Setting drawing LIMITS: LIMITS(PB,PE), where PB is the limiting coordinate on the lower left corner of the drawing area, and PE is the limiting coordinate on the upper right corner of the drawing area. It is important to note that STEC is similar to GKS and PHIGS, but they are fundamentally different: GKS and PHIGS are graphical display standards and are standards within CAD systems. They are concerned with the functional interface between I/O and the application. STEC calls CAD commands, builds on CAD systems, and is concerned with CAD command input criteria. In addition, STEC has 3d commands, SLISP language, and so on, which are more extensive than GKS and PHIGS. Clearly, STEC can continue to be expanded, modified, and refined as needed. The SLISP language is designed to augment STEC, so it is currently based entirely on AutoLISP's development of open format constructs. The only difference is that AutoLISP calls the AutoCAD command, while SLISP calls the STEC command.

5. Conclusion

To sum up, the interaction level of product information represented by STEP transforms the CAD interactive information content from environmental information to product information and then to operational information, thus realizing the remote real-time exchange of CAD products. But in the construction of 3D command need to further improve the CAD system real-time exchange technology.

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