



2011 International Conference on Advances in Engineering

## Research on the key technologies of web parts library in product configuration system

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### Abstract

In order to build a web-based parts library for the product configuration system, the data description norm, web browsing and application methods are researched. An ontology based data description norm is used to build the web parts library, with the help of product family and the article characteristic table. A plug-in file of Autovue is adapted for web-based browsing and interaction of geometric models of parts. The schema of Application Services Provider is used to realize the application of web parts library in the product configuration system. Empirical results show that the methods are feasible. And the library has been shown to illustrate the concept. The ontology based data description norm can solve the standardization problem. The plug-in file can show the online 3D demo of parts. And the application of ASP can help more companies to use the web parts library. These technologies help to build and use the library.

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Selection and/or peer review under responsibility of ICAE 2011

*Keywords:* web parts library; product configuration; data description norm; ontology

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### 1. Introduction

Product configuration is an effective product schema. It can solve the conflict between the multiple customers' demands and the cost of manufacturing. The key of product configuration is to use widely used parts and components. The high reliability and low costs can be realized in the configurable products. And the knowledge in the parts and components can be reused. The product configuration systems need reliable information of parts and components from the manufactories. And the assembly factories need dependable parts suppliers<sup>[1]</sup>. With the help of web parts library, the parts suppliers, the assembly factories and the customers can be connected together with the product configuration system. The web parts library is the fundamental of product configuration system, and it is also the resource library. The web parts library can supply the drawings and documents of parts and components. The online 3D demo of parts and components and the simulation of assembly can be realized by using web parts library. The results of product configuration can be sent to the parts suppliers through web parts library. And the levers of supply management and customer relation management can be raised. The key technologies of web parts library in product configuration system includes data description norm, browsing and interaction of geometric models of parts and static and dynamic workgroup permissions.

### 2. Ontology based data description norm of web parts library

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The data description norm of parts is to express the characteristics of parts. Ordinary data description norms of parts include semantic description norm, geometric model description norm, characteristic-based description norm and hierarchical structure description norm. Each norm has its advantages, but it also has shortcomings. For example, the names of parts in semantic description norm may be different in different suppliers' systems. So the standardization management of parts library is difficult.

### *2.1 Characteristics and requirements of web parts library*

A data description norm of web parts library should express the geometric model, topology and manufactory information of parts accurately and effectively. It is one of the key technologies of web parts library. In order to build the data description norm of web parts library, the characteristics and demands of web parts library should be discussed. In the application of web environment, the characteristics of parts have the following features<sup>[2]</sup>. The quantity of information is huge. And the information is not independent.

So the requirements of data description norm include the following. The structured and unstructured data can be expressed in order to build the hierarchical structure of web parts library. It has the separate mechanisms of data description drawing display. The data description norm is easy to use and unrelated to the platform. The norm has high flexibility and good expansibility. It is easy to maintain. And it is convenient for customers' retrieval.

### *2.2 Ontology based data description norm of web parts library*

Ontology is a concept of philosophy. It is widely used in the knowledge fields recently<sup>[3]</sup>. Ontology is used in this paper to build the web parts library in order to solve the following problems. Firstly, the standardization of terms in the parts library can be solved. The parts can be sorted reasonably. And the parts and other design resources can be reused. It is convenient to integrate the web parts library into other systems. And it can provide the expression mechanism for multiple suppliers<sup>[4]</sup>.

An ontology based data description norm is used to build the web parts library, with the help of product family and the article characteristic table.

#### *2.2.1 Part family*

Part family-oriented parts data description mechanism can achieve the following purposes. It can conduct effective management and unified description to various parts in the parts library. The part classification structure can be optimized and the structure of parts library can be simplified. And different data provider can access the parts library of with unified structure. And it can reduce the redundancy and inconsistency of parts information.

The hierarchy parts family is a tree structure with single inheritance relationship. The child node inherits all properties from the parent node. And each child has only one parent node. According to the classification level, parts can be divided into generic part family and simple part family. Generic part family is mainly used to build the classification system. And it is the foundation of rapid query and retrieval of parts. The general parts family is mutually exclusive and it is not instantiated. And the simple parts family is the family which spited from the general parts family. The simple parts family should be distributed in bottom of part family and must be instantiated as individual parts.

In Fig. 1, the upper is the generic part family. Different classification methods are used according to the situation and application demand of the companies. The lower is the simple part family. The tabular layouts of article characteristics and CAD parameterized template are used to identify and express parts. The CAD parameterized templates describe the geometry graphic information and topology information of parts. And the tabular layouts of article characteristics table inherit the classification feature of the generic parts family. They also describe the geometry, features, manufacturing characteristics and correlation algorithm of parts.

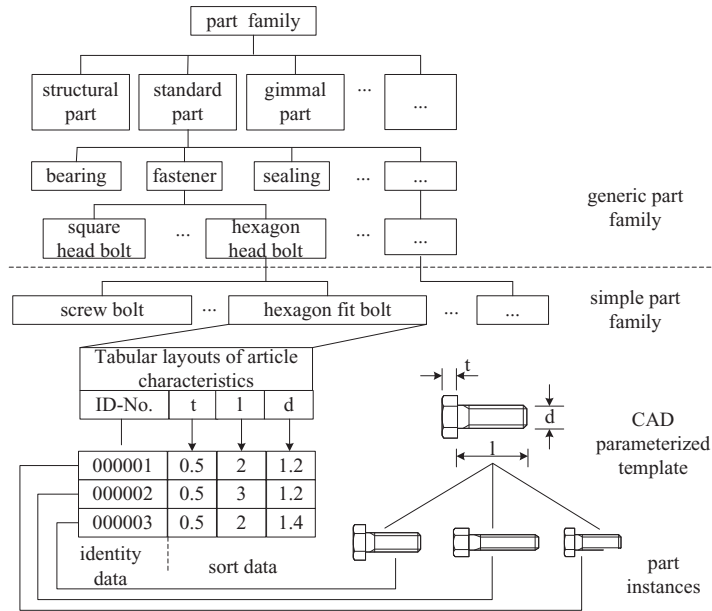


Fig. 1 Hierarchical information model of part library

2.2.2 Tabular layouts of article characteristics

Tabular layouts of article characteristics are the information collections of parts geometry, function and manufacturing characteristics. In order to build the parts database, tabulated forms use to describe parts characteristics.

Through using tabular layouts of article characteristics, the amount of parts instances stored in parts library can be reduced. And the structure of the parts library can be optimized. On the other hand, it is helpful to realize parameter-driven design and parametric search. It makes different enterprises describe parts in the same formats and specifications. It makes information interaction between enterprises. And it helps enterprises achieve standardization of parts information description.

When a simple tabular layouts of article characteristics of parts family is created, it should be based on standards, serialization and modularization principles. And the most important and frequently used parts features should be described. In Fig. 2, the structure of parts library hierarchy is built according to ISO/ICS standards. In the first level the version, vendor and other characteristics are defined. In the second layer the classification, features are defined. Materials and function features can be defined in the third floor. The names and dimension are defined in the fourth level. Below the fifth floor, only the specific size and other important features can be defined for it is simple parts family.

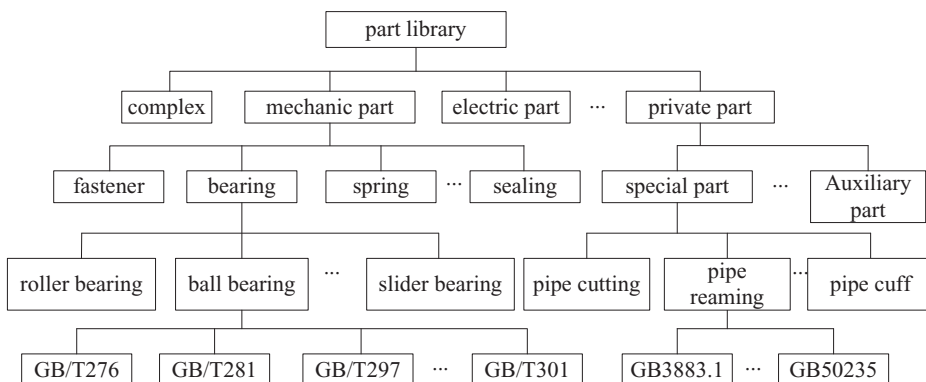


Fig. 2 Hierarchy of parts library according to ISO/ICS standards

3. Web-based browsing and interaction technology of geometric models of parts

After the product configuration, the results or solutions will be given. The bill of material will be sent to the

companies. And the quote will be sent to the customers. But now the drawings of product configuration results are rarely given in the web. This may cause certain influence to the customers.

Web-based browsing and interaction technology of geometric models of parts can realize the visualization of product configuration. Some mainstream CAD software suppliers can provide the web-based browsing and interaction technology for their own product. For example, the company of UG provides JT format for web browsing, the company of Pro/E provides Product View format and the company of Pro/E provides epart format. These kinds of file format are suit for web-based browsing and interaction for the sizes of format are small. And these formats can maintain the features of parts fairly good. But they are private, and they can only deal with the files created by their own product. VRML is a common file format for browsing and interaction. But it may lost many features of parts during the conversion.

The plug-in file of Autovue is adapted in our team. Through programming to this plug-in file, 3D CAD files can be seen in the browser without any conversion. The web-based browsing and interaction of a bicycle can be seen in Fig. 3.

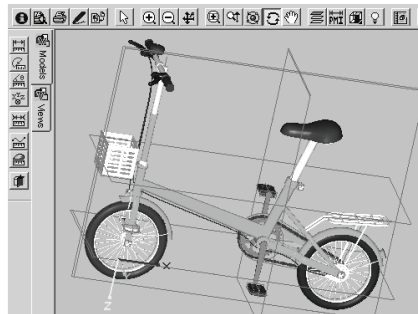


Fig. 3 Web-based browsing and interaction of a bicycle

#### 4. Application of web part library in the product configuration system

Application of web parts library in the product configuration system can be realized in two ways<sup>[5]</sup>. One way is to build up application server in the company. And the web parts library is deployed in the server. The library can be provided to the designers in the company. And it also can be provided to the partners and customers out of the company by some technology.

Another way is to build up web parts library thought Application Services Provider, ASP. The schema of ASP can provide the service for the middle and small companies. These companies are weak in building web part library. Through internet ASP provides the services of building, managing and retrieval part library just like the server is in the company.

Our team has already built up a standard part library based on the web. And it is distributed in the platform of ASP as seen in Fig.4. It provides the web service interface for other programs. Through the service, parts' information like dimensions and models can be retrieved.

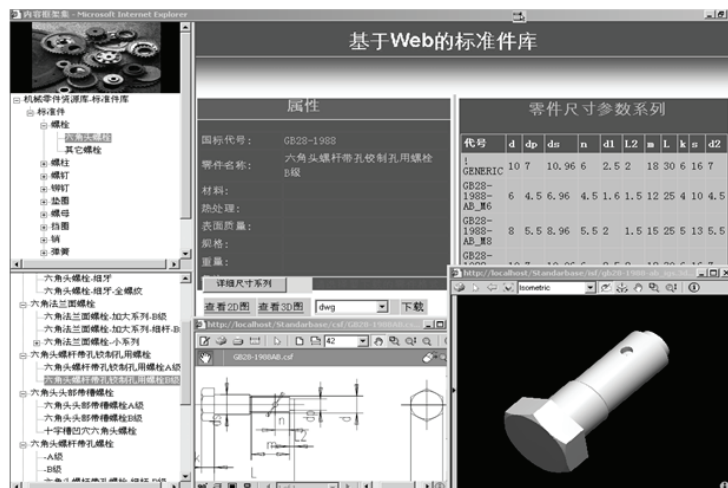


Fig. 4 Web based standard parts library

## 5. Summary

The function of web parts library in product configuration is analyzed in this paper. And some key technologies of web parts library in product configuration system are researched. An ontology based data description norm is proposed to build the web parts library, with the help of product family and the article characteristic table. A plug-in file is used for web-based browsing and interaction of geometric models of parts after programming. The application of web parts library in the configuration process is described in the end.

## Acknowledgements

This paper is supported by the scientific research foundation for the doctoral program of University of South China (No.2007XQD35), the educational commission foundation of Hunan province of China (No. 09C858) and the natural science foundation of Hunan province (No.10JJ4037).

## References

- [1] Pine, B. J II. *Mass Customization: The New Frontier in Business* [M]. Boston: Harvard Business School Press, 1993.
- [2] Phillip Ackermann. PLM-integrated Configurators for Machine and Plant Construction [A]. Proceedings of the 19th International joint Conference on Artificial Intelligence Workshop on Configuration[C], France, 2005:57-59.
- [3] Meng Xu, Yinglin Wang. Ontology Based Unstructured Text Query[A]. IEEE International Conference on System, Man and Cybernetics[C], 2004:1426-143.
- [4] Ying-Lie O. Configuration for mass-customisation and e-bussiness [A]. 15th European Conference on Artificial Intelligence[C], Configuration Workshop, 2002:11-16.
- [5] Ardissono L., Felfernig A., Friedrich G. Framework for the Development of Personalized, Distributed Web-Based Configuration Systems [J]. AI Magazine, 2003(24):93-108.