Classifying and coding system of turbine parts based on internal and external codes

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Abstract. Based on the smooth implementation of PDM in enterprises, this paper focuses on the system structure of classification and coding system, puts forward the concept of internal and external codes, and develops a product classification and coding system based on internal and external codes with reference to various classification coding systems at home and abroad. Internal and external codes are used separately in different department of the enterprise and their function is different, so it can solve the past problem of long codes and make the value of every code fully utilized. It is shown from the application that internal and external codes can meet the requirements of PDM for the classification and coding of turbine parts and contribute to its successful implementation in the enterprises.

1. Introduction

With the rapid development of Product Data Management (PDM) and the increasing amount of enterprise information, people have higher and higher requirements for classification and coding system, such as providing the required information for various departments of the enterprise, rather than all the information. The structure of the coding system is researched mainly and a concept of internal and external codes is putted forward, the Classifying and Coding System of Mechanical Product based on internal and external codes is developed, which was applied in the implementation of the PDM of one enterprise.[1-3]

2. Classification and coding system of mechanical products based on internal and external codes

2.1. The concept of internal and external codes

In the internal and external code system, according to the different shape and functional characteristics of mechanical products, the classification code is divided into two parts: external code and internal code. The external code is the unique identification of things. The same thing, no matter where it appears, has the same external code, while different things have different external code. In the manufacturing industry, the external code can be used as the coding of products and parts, instead of the traditional drawing number, as the unique identification of products and applied in enterprises, and also as the identification of providing after-sales service for customers; the internal code is a detailed description of the characteristics of things, but it does not have uniqueness, which is mainly used by the internal personnel of the enterprise, and details the products in the design and manufacturing information. It is helpful for the internal personnel to identify the similar products. The architecture is shown in Figure 1.

The internal code describes all aspects of the part information, and its code bit length is generally longer than the external code. The internal code mainly describes the design and process information.
of parts, and can also include some other auxiliary information. The formulation of internal coding rules can refer to the existing standard coding system such as JLBM-1, etc., and combined with the actual situation of the enterprise, that is, based on the standard coding system, some modifications should be made according to the particularity of enterprise products\textsuperscript{[4]}. For the coding rules of internal codes, it needs to go through a period of trial period and modify them repeatedly until they are satisfied. The internal code structure is shown in Figure 2.

The external code plays the role of unique identification in the whole coding structure. On the premise of fully meeting the product coding capacity, the coding length should be as short as possible to facilitate computer processing and manual identification and maintenance. The external code is composed of basic attribute and sequence code. For product coding, the basic attribute can refer to the name category of product parts, such as rotary parts, box parts, sheet metal parts, welding parts. According to the basic attribute code, parts can be easily identified, but the attribute code does not contain the specific processing technology information of the parts. The function of sequence code is to distinguish product parts\textsuperscript{[5-6]}. It can be generated in the way of serial number or according to certain rules. This kind of external code has certain confidentiality and is conducive to the maintenance of enterprise parts. The external code structure is shown in Figure 3.

### 2.2. Implementation process of internal and external code coding

In the internal and external code coding, the internal code is generated first, and then the external code is generated. Since the internal code has fully described the information of the part, when coding a part, if its internal code is different from all existing internal codes, it must be a new part, and naturally a new external code should be generated; if there is the same internal code, since the internal code is only a similarity description, it may have been coded before, so it should be checked for duplicate code. Duplicate code check: first check the internal code, and then compare whether the drawings are the same, that is, according to the specific size, process information, etc. If the comparison results are identical, it is proved that the part has been coded and there is no need to code again; if the comparison results are different, the external code can be compiled. Only the parts that have not been coded before can be produced with the external code through the double code inspection, so as to ensure the uniqueness of the external code, the component will get the corresponding unique identification. The implementation flow of internal and external codes is shown in Figure 4.
3. Development of mechanical product classification and coding system based on internal and external codes

This project is commissioned by a turbine machine Co., Ltd. in Jinan. The company is a high-tech enterprise specializing, production and sales of turbine processing equipment. It has the largest turbine equipment processing base in China. It is a typical machinery manufacturing enterprise, which can reflect the current situation of China's machinery manufacturing industry. Due to the fierce competition in the domestic market, enterprise products need to be constantly updated and modified to meet the needs of various users and the changing market requirements, which puts forward strong requirements for the implementation of enterprise classification coding, so as to shorten the design and production time of enterprises and meet the requirements of new products on the market as soon as possible.

Figure 4. The implementation flow of internal and external codes.

3.1. Definition of internal code rules

Coding rules are the basis of product coding and the first step of coding. According to the actual situation of the company, the formulation of internal coding rules refers to JLBM-1 and other coding systems, and has made a lot of revision work. The specific internal code structure is shown in Figure 5.

Figure 5. The specific internal code structure of parts.

The first two digits of the internal code are the name category code. As the parts of the company are mainly divided into rotary parts and non-rotary parts, and mainly plate and rotary parts, the name category matrix refers to the name category of JLBM-1 system for classification. According to the difference of the first two name category codes, the remaining code bits define the design, process information and auxiliary information of parts, and define the features of rotary parts, non-rotary parts and sheet metal parts respectively.

3.2. Definition of external code rules

The external code is composed of large class identification code, name category code and sequence code, and the name category code of external code is exactly the same as that of internal code. The
specific structure of external code of parts is shown in Figure 6. Category identification code is used to distinguish all parts and components of an enterprise. The parts of a company are mainly divided into the following five categories: self-made parts, standard parts, purchased processing parts, components and complete machine. Therefore, the classification and coding system is identified by the letters P (part), s (standard part), O (outgoing part), C (component), w (whole machine). If the enterprise needs to add other parts categories, it can also use other letters to expand the classification space of the system. Because the names and category codes of the internal and external codes of the system are identical, the system only needs to define the large class identification codes of the external codes, while the sequence codes are automatically generated, and there is no need to define them again. For standard parts, the classification and coding system adopts the method of national standard plus sequence code; for components and complete machine, it adopts mixed coding mode; The sequence code of the external code should fully consider the development of the enterprise and be automatically generated by the computer to ensure the unique identification function of the system for parts and components. If it is too short, it is easy to overflow, and if it is too long, it will waste resources. Because the total number of parts in a company is more than 20000, it can meet the requirements by taking four digits.

4. Conclusion
Using internal and external codes in the classification and coding system of mechanical products can effectively solve the two problems of classification and coding. It uses a short external code and an internal code with a certain length, which can not only meet the requirements of coding capacity, but also fully describe the product information. The matching use of external code and internal code provides an effective way to realize enterprise information integration. In product development design and process design, similar information query can be realized; feature matrix of similar part family can be established by using component design and process information described by internal code, so as to facilitate similar part design and process design, so as to improve design efficiency and maximize the use of existing design and process resources.

References
[1] Tong, B.S., Li, J.M. (2000) Product Data Management Technology. Tsinghua University Press, Beijing.
[2] Cui, H., Sheng, B.Y. (2015) Research and application of product coding system in PDM system. Software Guide, 3: 12-16.
[3] Luo, X.T., Li, W.L., Yang, K., Liu, J.X. (2017) Research on the application of parts classification and coding in weapon products. Standard Science, 1: 46-50.
[4] Yao, H. (2012) Research on the application of information coding in PDM system. Equipment Manufacturing Technology, 5: 153-160.
[5] Wei, J.X., Hua, Q.S. (2017) Suggestion on material coding scheme selection in ERP system. Agricultural Equipment and Vehicle Engineering, 4: 17–22.
[6] Zhuang, D.S., Fu, M.M. (2013) Design of practical PDM drawing and document management platform. Journal of Sichuan Military Technology, 12: 33-35.