Computer system for casting defects classification based on Polish, French and Czech specifications


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Abstract

Many foundries existing in Poland make casts for local and external market. It is necessary to adopt a quality control to client’s requirements. The main problem in the quality control of casting products is to detect and to classify properly defects. Polish defect classification is based on the Polish Norm. In other countries (Czech Republic and France for example), other systems exist for classification, they are based on the different criteria and groups of defects. In other word the classification of casting defects is country-specific. Translation of defects names and their descriptions introduce additional level of difficulties. The authors propose multi-context system for finding equivalents of casting defects from one classification system to another, using original languages for each classification.

Keywords: Casting faults, Faults classification, Database

1. Introduction

The concurrency is one of the main attributes of economic units in the contemporary market, and it is closely related to quality of marketed products. Now in Poland, production of cast is scattered throughout the country. There are many small casting facilities producing for export and local market. A quality control of casts produced in Poland is regulated by the Polish Norm[1]. The main target of quality control is to reveal casting faults or abnormalities in products and to classify them correctly. Determination of causes of those faults and its prevention could have positive influence on competitiveness of a casting plant by the reduction of losses. Some monographs concerning the casting faults exist in Poland and in foreign countries as well. They are published as norms, atlases, handbooks or in other forms [1-5]. They differ from each other with precision of the faults description, with quantity of information and images of faults. The main problem on the international level is a large dispersion in the nomenclature of casting faults and different criteria used for its classification. In The Polish Norm [1] 52 casting faults are characterised. They are classified in 4 groups: W-100 (shape faults), W-200 (defects on the raw surface), W-300 (continuity defects), W-400 (defects in the bulk of the cast). In the Czech Republic other system of classification is used. 108 defects are divided on 7 groups like: 100 (shape, weight and dimension faults), 200 (surfaces defects), 300 (continuity defects), 400 (cavities), 500 (macro inclusions and macro-structural defects), 600 (micro-structural defects), 700 (deviation from chemical composition and chemical property faults) [3]. In France 116 defects are distinguished, they are divided in 7 classes but with slightly
different classification criteria than those used in the Czech system and of course in the Polish one. In the French system the main groups are: knobs and feed-heads (A), cavities (B), discontinuities (C), defected surface (D), short run (E), incorrect shape or dimensions (F), inclusion and defects of structure (G). This diversity in the defects classification systems lead to lack of direct equivalents and create problems in communication and identification of a particular defect. Such a situation is presented on the figure 1. The defect W-209 named the rattails or “rat tails” (blizna) was chosen from the Polish Norm. This defect is assigned to the W-200 group that is “defects of the raw surface”. In the French system this defect has 3 equivalents in the groups A (A114) and D (D133, D231). 3 equivalents exist in the Czech system as well: in the group “surface defects” 220 – 221 – rattails on the upper surface of a casting mould, 222 – rattails on the bottom of a casting mould, 223 – veining.

Fig. 1. French, Czech and Polish casting faults classification systems

In this work, the Multi-context Casting Faults Classification System (MCFCS) is presented. This system has two applications: first – searching of equivalents for chosen defect in other two classification systems, second – translation between the languages. The computer program lets to choose language and then the list of defects in this language is generated from the database. After choice of defects a query searches in database corresponding names of defects in other languages. Within the search of defects names corresponding to chosen defect in Polish classification, additional information about this defect is displayed.

The base for translations is a dictionary attached to the Polish Norm. In the case of casting defects in French or Czech languages in the result several similar defects could be displayed, because the quantity of the sets of defects distinguished by names in analysed languages are different, as it was mentioned in introduction. In such a situation this computer program is capable to choose and cluster names, which are close in meaning.

2. Description of the MCFCS system

2.1. Used technology

Two factors had influence on the technology used for MCFCS system. The first was portability understood as a possibility run the program within any operating system. That was the reason to choose the java virtual machine and the java language in the part responsible for communication with a user or other computer programs, creation of queries to the database and discovering similarities between different classification systems. The second factor was possibility of integration with the existing information system for the foundry engineering [6, 7]. In this implementation, the database Oracle Database 10g Express Edition was used, which has limited but sufficient functionality and assure compatibility with the commercial full-featured database.

2.2. The database

The back-end for store the data of the MCFCS is the relational database Oracle, containing eight tables tied together with relations showed on the figure 2

![Fig. 2. Schema of relations between tables in database](image)

The main tables in this database are: NormaPL – figure 3, NormaCZ – figure 4 and NormaFR – figure 5. The table NormaPL was created on the base of Polish Norm[1], the table NormFR contains names of the casting defects in French language[4], based on the French classification, and the table “NormaCZ” was filled out with groups and names of defects taken on the Czech specification[3].
Many-to-many relationships cannot be directly modelled in relational database programs. These types of relationships must be broken into multiple one-to-many relationships using additional table. The table “Tabela główna” accomplishes this task (figure 6). It allows establishing relationships amongst defects in different classifications, to search of equivalents of defects in other classification systems. Another many-to-many relationship was created between tables “GrupaFR” and “GruaCZ” for clustering similar defects. Two additional tables “Słowa” and “Normy Słowa” contain a set of attributes characterising casing defects and its connections with particular defect respectively.

### 2.3. Example of use of MCFCS

Let's consider following example, a user knows name of the defect in Polish language. After start of the program, the first dialog box appears and it contains list of languages. Then in a drop-down a defect in chosen language can be selected for the query as it is shown on the figure 7.

![Fig. 7. Dialog Box with choice of languages and defects](image)

Considering that a defect with the Polish name “blizna” (rattail) was chosen, then the system create a query to the table NormaPL in the database and related tables (“Słowa” and “Normy Słowa”). A description of this defect and keywords related to them are displayed. The keywords are values of attributes taken from the table “Słowa” and “Normy Słowa”. The figure 8 shows the effect of this operation for the defect “BLIZNA” (rattail). In this case 7 equivalents were found in two languages, which mean that 7 similar names appear in analysed specifications.
The system searches in all three tables representing three classification systems for existence of keyword assigned to this defect in Polish classification. The result of such query is presented on figures 9 and 10.

The defect – rattail (“blizna”) has following equivalents in other systems:
- in the French system 3 defects are found: one in group A (A114) and two in group D(D133, D231),
- in the Czech system 4 equivalents are found – all group 220 (surface defects) and particularly 221 rattails on an upper surface, 222 – rattails on a bottom of a casting mould, 223 – veining.

If the defect has not equivalents in other classification systems only its description and keywords are displayed.

3. Conclusions

Presented in this paper Multi-context Casting Faults Classification System MCFCS could be used as an educational aid and a tool for Polish manufacturers of casting products for the Czech and French markets.

In the final version of this system will be extended to cover two other classification systems (Deutsch and American) and languages: Deutsch and English. The capability of using synonyms in the search will be introduced. The functionality of this system will be available in the Internet network as a part of bigger information system.

4. References