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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 base nod 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 loses. 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.

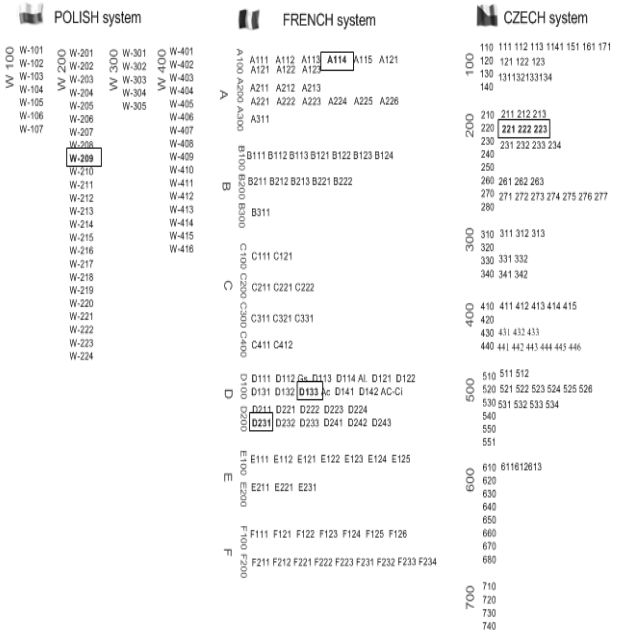


Fig. 1. French, Czech and Polish casting faults classification systems

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

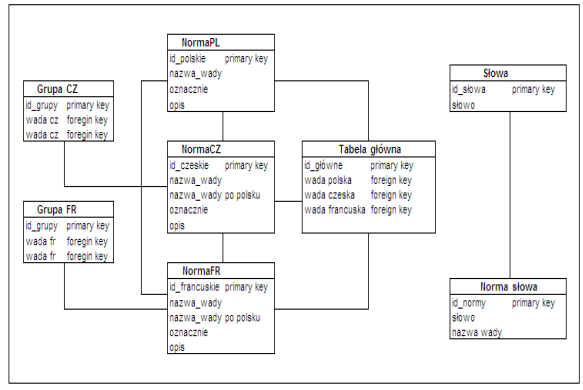
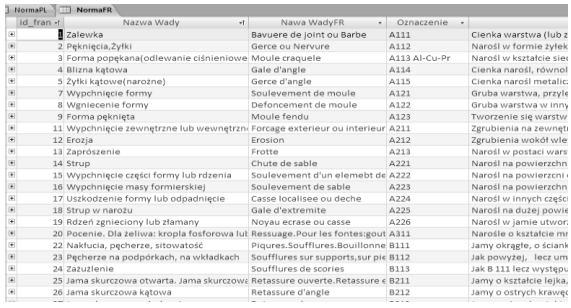


Fig. 2. Schema of relations between tables in database

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].

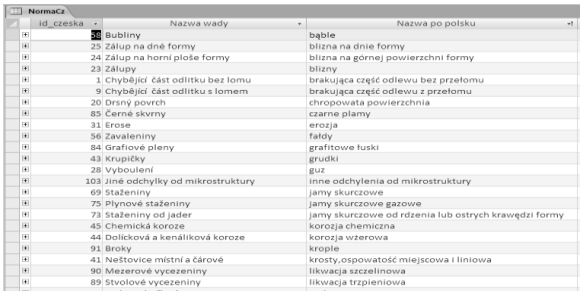
id_pols	Nazwa Wady Polska	Oznaczenie	Opis
1	USZKODZENIE MECHANICZNE	W-101	naruszenie kształtu odlewu,mające postać wyszczerbienia,odłamania części wystającej
2	NIEDOLEW	W-102	niezupełne odtworzenie kształtu odlewu,charakteryzujące się najczęściej stępionem za
3	GUZ	W-103	małe,miejscowe,wypukłe odkształcenie powierzchni odlewu
4	ZALEWKA	W-104	cienka warstwa metalu występująca w miejscach niedokładnego przylegania do siebie
5	PRZESTAWIENIE	W-105	przesunięcie względem siebie oddzielnych części odlewu na powierzchni podziału form
6	WYPCHNIĘCIE	W-106	wyraźne odkształcenie powierzchni odlewu mające kształt opuchlizny,często pokryte ż
7	WYPACZENIE	W-107	odkształcenie osi geometrycznej odlewu lub jego części przy zachowaniu wymiarów po
8	CHROPOWATOŚĆ	W-201	nierówność o wielkości,ilości i rozmieszczeniu niezgodnych z wymiarami odlewu
9	PĘCHERZ ZEWNĘTRZNY	W-202	zagłębienie na powierzchni odlewu o kształcie owalnym
10	KORNIK	W-203	płytkie rozgałęzione rowki na odlewie staliwnym,o małej chropowatości powierzchni,n
11	OSPOWATOŚĆ	W-204	skupienie na powierzchni odlewu płytkich owalnych wgłębień
12	NAKŁUCIA	W-205	cienkie kanaliki o małej chropowatości powierzchni,skierowane w głąb odlewu,tworzą
13	OBCIĄGNIECIE	W-206	zazwyczaj płytkie dość duże wgłębienie o małej chropowatości powierzchni i o zarys
14	FAŁDA	W-207	bardzo wąska przechodząca lub nie przechądząca na wskroś szczelina o zaokrąglonych b
15	STRUP	W-208	nieregularna narośl na powierzchni odlewu,czasem z wtrąceniami materiału formierski

Fig. 3. The table - NormaPL



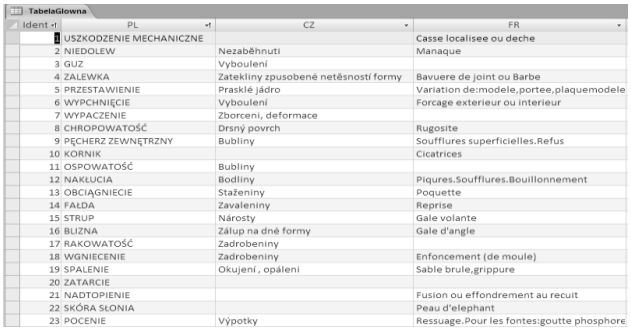
id_fran	Nazwa Wady	Nawa WadyFR	Oznaczenie	
1	Zalewka	Bavuere de joint ou Barbe	A111	Cienka warstwa (lub z
2	Pęknięcia,Żyłki	Gerce ou Nervure	A112	Narośl w formie żyłek
3	Forma popękana(odlewanie ciśnieniowe	Moule craquele	A113 Al-Cu-Pr	Narośl w kształcie sie
4	Blizna kątowa	Gale d'angle	A114	Cienka narośl, równol
5	Żyłki kątowe(narożne)	Gerce d'angle	A115	Cienka narośl metalic
7	Wypchnięcie formy	Soulevement de moule	A121	Gruba warstwa, przyle
8	Wgniecenie formy	Defoncement de moule	A122	Gruba warstwa w inny
9	Forma pęknięta	Moule fendu	A123	Tworzenie się warstw
11	Wypchnięcie zewnętrzne lub wewnętrzn	Forcage exterieur ou interieur	A211	Zgrubienia na zewnęt
12	Erozja	Erosion	A212	Zgrubienia wokół wle
13	Zaprószenie	Frotte	A213	Narośl w postaci wars
14	Strup	Chute de sable	A221	Narośl na powierzchn
15	Wypchnięcie części formy lub rdzenia	Soulevement d'un elemebt de	A222	Narośl na powierzchni
16	Wypchnięcie masy formierskiej	Soulevement de sable	A223	Narośl na powierzchn
17	Uszkodzenie formy lub odpadnięcie	Casse localisee ou deche	A224	Narośl w innych częśc
18	Strup w narożu	Gale d'extremite	A225	Narośl na dużej powie
19	Rdzeń zgnieciony lub złamany	Noyau ecrase ou casse	A226	Narośl w jamie utwor
20	Pocenie. Dla żeliwa: kropla fosforowa lul	Ressuage.Pour les fontes:gout	A311	Narośle o kształcie mr
22	Nakłucia, pęcherze, sitowatość	Piqures.Soufflures.Bouillonne	B111	Jamy okrągłe, o ścian
23	Pęcherze na podpórkach, na wkładkach	Soufflures sur supports,sur pie	B112	Jak powyżej, lecz um
24	Zaduślenie	Soufflures de scories	B113	Jak B 111 lecz występu
25	Jama skurczowa otwarta. Jama skurczow	Retassure ouverte.Retassure	B211	Jamy o kształcie lejka,
26	Jama skurczowa kątowa	Retassure d'angle	B212	Jamy o ostrych krawę

Fig. 4. The table - NormaFR



id_czeska	Nazwa wady	Nazwa po polsku
32	Bubliny	bąble
25	Zálup na dně formy	blizna na dnie formy
24	Zálup na horní ploše formy	blizna na górnej powierzchni formy
23	Zálupy	blizny
1	Chybějící část odlitku bez lomu	brakująca część odlewu bez przełomu
9	Chybějící část odlitku s lomem	brakująca część odlewu z przełomu
20	Drsný povrch	chropowata powierzchnia
85	Černé skvrny	czarne plamy
31	Erose	erozja
56	Zavaleniny	fałdy
84	Grafiové pleny	grafitowe łuski
43	Krupičky	grudki
28	Vyboulení	guz
103	Jiné odchylky od mikrostruktury	inne odchylenia od mikrostruktury
69	Staženiny	jamy skurczowe
75	Plynové staženiny	jamy skurczowe gazowe
73	Staženiny od jader	jamy skurczowe od rdzenia lub ostrych krawędzi formy
45	Chemická koroze	korozja chemiczna
44	Důlková a kanálková koroze	korozja wżerowa
91	Broky	krople
41	Neštovice místní a čárové	krosty,ospowatość miejscowa i liniowa
90	Mezerové vycezeniny	likwacja szczelinowa
89	Stvolové vycezeniny	likwacja trzpieniowa

Fig. 5. The table – NormaCZ



Ident	PL	CZ	FR
1	USZKODZENIE MECHANICZNE		Casse localisee ou deche
2	NIEDOLEW	Nezabĕhnuti	Manaque
3	GUZ	Vyboulení	
4	ZALEWKA	Zatekliny zpusobené netěsností formy	Bavuere de joint ou Barbe
5	PRZESTAWIENIE	Prasklé jádro	Variation de:modele,portee,plaquemodele
6	WYPCHNIĘCIE	Vyboulení	Forcage exterieur ou interieur
7	WYPACZENIE	Zborcení, deformace	
8	CHROPOWATOŚĆ	Drsný povrch	Rugosite
9	PĘCHERZ ZEWNĘTRZNY	Bubliny	Soufflures superficielles.Refus
10	KORNIK		Cicatrices
11	OSPOWATOŚĆ	Bubliny	
12	NAKŁUCIA	Bodliny	Piqures.Soufflures.Bouillonnement
13	OBCIĄGNIECIE	Staženiny	Poquette
14	FAŁDA	Zavaleniny	Reprise
15	STRUP	Nárosty	Gale volante
16	BLIZNA	Zálup na dně formy	Gale d'angle
17	RAKOWATOŚĆ	Zadrobeniny	
18	WGNIECENIE	Zadrobeniny	Enfoncement (de moule)
19	SPALENIE	Okujení , opálení	Sable brule,grippure
20	ZATARCIE		
21	NADTOPIENIE		Fusion ou effondrement au recuit
22	SKÓRA SŁONIA		Peau d'elephant
23	POCENIE	Výpotky	Ressuage.Pour les fontes:goutte phosphore

Fig. 6. The table - "Tabela główna"

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 "*GrupaCZ*" 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.

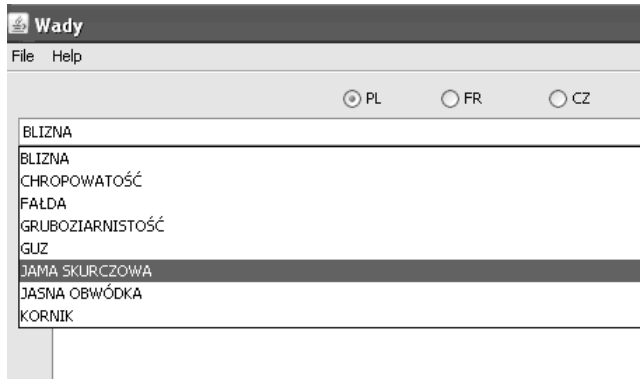


Fig. 7. Dialog Box with choice of languages and defects

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" tied with this defect using the table "*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.

Fig. 8. Information found by the system for the defect rattail („BLIZNA")

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.

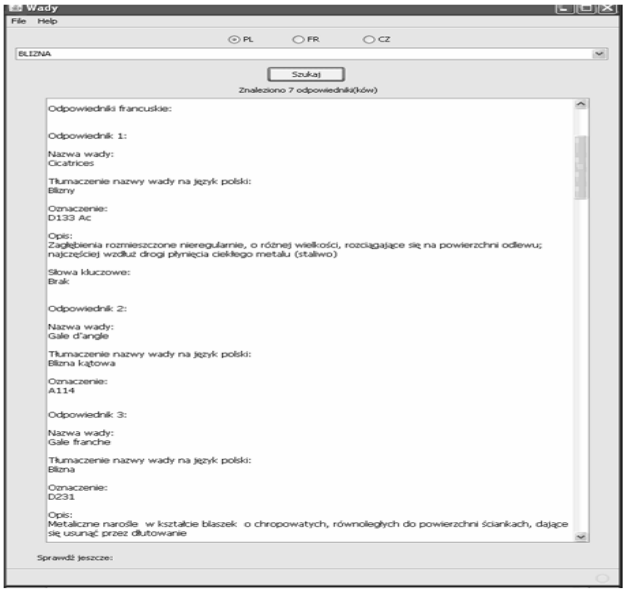


Fig. 9. The result of query for defect rattails ("BLIZNA") in French classification system.

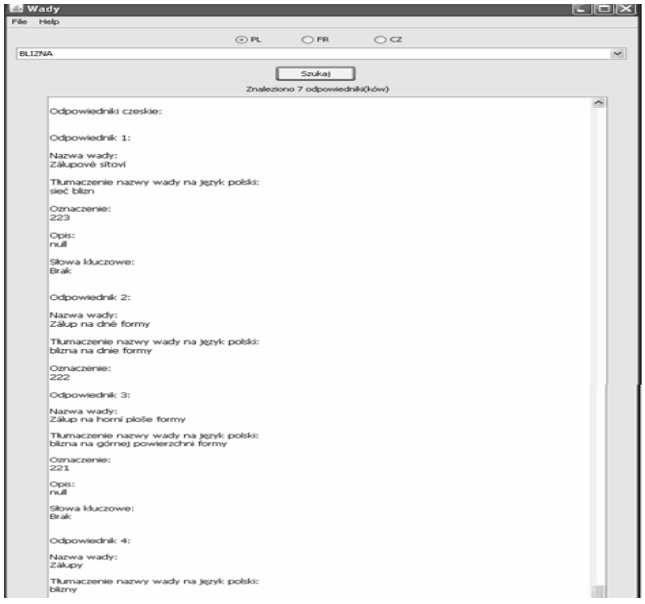


Fig. 10. The result of query for defect rattails ("BLIZNA") in Czech classification system

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

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