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Development of a Tool for Programming the Machining Instructions in a CAM Environment

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DEVELOPMENT OF A TOOL FOR PROGRAMMING THE MACHINING INSTRUCTIONS IN A CAM ENVIRONMENT

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I. INTRODUCTION

he programming of CNC based on standard programming languages. It turns out that these standards are not complete. The directors of CNC (DNC) to adapt the specifications of their machines. The standards describe programming languages also called commands. Each builder DNC trying by all means to differentiate its products from those of competition, and develop the standard programming languages [1].

The program content is developed with reference to the ISO standard for machine language frequently in control manager regarding the specificities of each manufacturer DNC. Since each manufacturer control manager tries by all means to differentiate its products from those of the competition and develops programming languages standard FANUC SINUMERIK, NUM, SIEMENS, PHILIPS, BOSCH, FAGOR, MAZOL, .

A set of tutorials enabling the discovery and language learning machine was developed highlighting some functions preparatory core and CNC technology. We can quote EMCO, DENFORD, PROCAM, Tour Assistance, the ARDEM (Association for Research and Development Multimedia Computer Education) who developed three tutorials (CONCEPT CN CN DIDA, IPMO). the association MECAPASSION. DS. SOLIDCONCEPTER software provides several commands, using the operator command is equivalent to choosing the post desired processor. Orders and REALMECA FAGOR offer intuitive tools to machines, using a group technology based on statements of form (dot machining operations). Other work has been developed to provide the learner the basics of CNC programming, but limited to one language [2].

This work aims to study the incompatibility of NC commands the most used and the development of a tool for NC programming in a CAM environment.

II. INCOMPATIBILITIES ADDRESS

The most common standard is the ISO standard (ISO 840) which defines the alphabet based on the ASCII code and additional standards that define the programming format (ISO 1056, 1057, 1058, 1059, 2539) [3].

Table 1 shows some differences in codes with two names for the same code [4,7].

Table 1 : Incompatibility of codes based on a
designation

Codes	Turning	Milling
G76	Threading cycle	bore
G90	Removal cycle	absolute programming
G92	Threading cycle	absolute programming
G94	Face turning cycle	Feed (minute)
G98	Feed (minute)	Return to starting point

Some manufacturers of DNC (FANUC, FAGOR) use the same code in turning and milling for two different designations such as for Fanuc and different codes for the same designation. These differences are even more pronounced in the case of FAGOR. To the SINUMERIK, the same codes are generally used for the same designations. As for the NUM control, using the ISO code, there have been no differences in designation for the same code.

With the exception of preparatory functions and auxiliary functions, the result after the statistical study of these addresses the following [5, 10]:

-37.50% use the same designation

-25% use two names

- -08.33% use three designations
- -08.33% use four designations

- -08.33% use five names (addresses Q, H)
- -04.16% use seven nominations (address P)
- -04.16% use eight nominations (Address R)
- -04.16% use nine nominations (e-K)

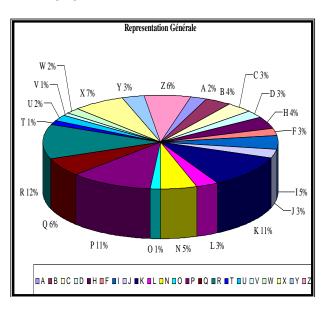
Faced with a likely lack of consultation and a fierce business competition, it continues to see a nonuniformity of language difficulties caused by the programming of CNC [6]. Hence the importance of developing a tool for NC programming for different orders.

III. STATISTICAL STUDY ON NC ADDRESSES

The programming of CNC machines based on standard programming commands. These standards are incomplete. Builders directors CNC fit the specifications of their machines.

NF standards (ISO 6983-1) (NF Z68-037), NF [ISO 4342] describe programming languages [8]. These are inconsistencies despite numerous standardization efforts.

Figure 1 shows a general representation of incompatibilities NC addresses for different commands studied [10].





IV. TOOL DEVELOPED

To overcome the problems posed by these inconsistencies, contributing to an educational module for NC addresses for FANUC SINUMERIK NUM FAGOR in turning and milling commands has been developed.

This tool has several functions, which are:

- Preparation of the workstation (Figure 2);
- Examples of machining operations such as:
- ✓ Training (Figure 3);
- ✓ Bore (Figure 4);

- ✓ Circular interpolation (Figure 5 , 6);
- ✓ Linear interpolation (Figure 7);
- Designation of preparatory functions after choosing "control / operation" and the "G -code" (Figure 8)
- Designation of auxiliary functions after selecting the "control" (Figure 9);
- Identification of all addresses A to Z (Figure 10);
- Automatic calculation of various cutting parameters (Figure 11, 12)





Figure 2: 26: Preparing the Workstation



Figure 3 : Example of Training



Figure 5 : Example of circular interpolation in turning



Figure 4 : Example of Bore



Figure 6 : Example of linear interpolation (G01) in milling

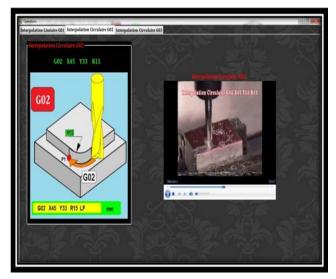


Figure 7 : Example of circular interpolation (G02) in milling

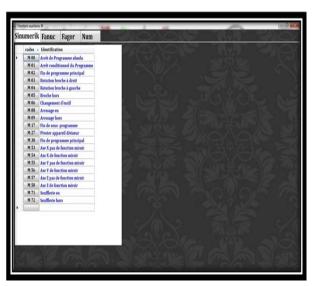


Figure 8 : Identification of G-codes



Figure 9 : Identification of M-codes





Figure 10 : Examples of identification of CN codes A to Z in turning, milling

açage en bout Suriay	ige en rouisine	en roulant Fraisage combiné prédominance en roulant Rainurage en bout Rainurage en roulant							HALFING		101
Natiens	Fraise monobloc ANS	Fraise Neosoblac ARS	Fraine Monoblac ARS	Fraize Monobloc ARS	Fraise à CM	Fraise & CM	Praise à CM	Prase 3.01	Matériaux Eb ARS	Acier au C s 0	25%
1	It Ebauche (m/.	Ve Pantion (m/	Arance par dent.	Arance par dent.	Vt Ebus (m/min)	Vt (F) m/min	Avance par dent.	Arance par dent.	LU ARG	EDUM	-
Aciers au Mo+5	48-53	55-63	0.15-0.2	0.1-0.15	140-160	180-210	02-05	01-02		10	
Ariers au Mn+5	10	46-53	0.15-0.2	01-015	115-125	123-135	62-03	01-02	Ve	40	m/min
Atter au C s 0.25%	40-45	45-50	0.15-0.2	0.1-0.15	120-130	160-170	0.2-0.3	0.1-0.2	6	0,15	mm/den
atier au C s 0.45%	24-28	32-38	0.13-0,2	0.1-0.15	100-110	120-130	0.2-0.3	0.1-0.2			time unit
Atter au C s 0.65%	16-18	21-25	0,10-0,15	0.1-0.12	80-90	100-110	0.15-0.25	0.08-0.18	D	13	1111
Atier au C & 0.90%	12-14	20-24	0.10-0.15	0.1-0.12	68-75	90-100	0.15-0.25	0.07-0.15			
Atters albés 5 5 au Cr+M	22-25	31-33	0.13-0.2	0.1-0.15	95-105	120-110	02-03	0.1-0.2	Z.	8	dents
Atier alliés i 5% au Cr+N	16-18	20-22	0.1-0.15	0.1-0.12	75-85	100-110	0.15-0.25	0.1-0.2		979,91180793	Tr/mn
Atiers albés 5 5 au N+O	12-14	18-21	0.1-0.15	0.1-0.12	68-73	90-95	0.15-0.25	0.00-0.15	1	111,11100177	**/****
Atiers albés 5 5% au Cr	12-14	17-20	01-015	0.1-0.12	45-50	65-00	0.10-0.18	0.10-0.18 #	F	146,98677119	mm/mn
Fontes ferritique PGL200	35-40	45-55	02-03	0.2-0.25	110-120	150-160	0.4-0.5	0.15-0.25			
Fontes Ferri-Perist.FGL30	18-20	20-28	0.15-0.2	0.2-0.25	80-90	110-120	0.3-0.4	0.15-0.25		Calcul	
Fontes Perkitique FGL400	12-14	16-18	0.15-0.2	0.1-0.15	70-77	92-110	0.15-0.25	0.1-0.2		Calcul	
Fontes GS Fernt FGS600	12-14	16-18	0.15-0.2	0.1-0.15	58-62	75-80	0.3-0.4	01-02	Fin ARS		
Fontes GS Ferrit, FGS370-1	7. 30-34	39-34	02-025	0.1-0.15	115-125	160-170	0.4-0.5	0.1-0.2	FINARS	Fin CM	
Fontes malléables à couer h	an 42-46	54-60	01-02	0.1-0.15	145-155	190-200	0.4-0.5	0.15-0.25	Ve	45	m/min
Fontes malifables à couer n	nie 24-26	35-38	01-02	01-015	85-95	115-125	0.3-0,4	0.15-0.25			
Fontes malléables peritiqu	15-17	20-24	0.1-0.15	0.1-0.12	82-88	92-100	03-035	0.1-0.2	fz	0,1	mm/den
Aders Inex Martensique	24-28	32-38	0.1-0.15	0.1-0.12	72-77	92-100	0.15-0.25	0.1-0.2	D	10	mm
Aciers Innx Austrinitique	18-21	24-28	0.1-0.15	0.1-0.12	81-87	110-120	0.15-0.25	0.1-0.2			
Acters à outils au Cr	9-11	12-14	0.08-0.1	0.08-0.1	41-45	55-60	02-03	0.1-0.2	z	6	dents
Aders à outils au Cr+Mo+	15-18	19-22	0.08-0.1	0.08-0.1	64-78	85-90	0.15-0.25	01-02		1433.12101910	Tr/mn
Atters à outils au W+Cr+1	14-16	17-20	0.06-0,1	0.06-0.1	59-63	78-94	0.15-0.25	0.1-0.2	3	_	
Latons au Zn+Al	72-80	90-100	0.15-0.20	0.12-0,18	135-150	180-200	0.2-0.3	0.15-0.2	F	143,312101910	mm/mn
Lature à l'Atain	28-33	41-46	01-015	0.05-0.12	70-78	80-88	0.2-0.25	0.15-0.2			
Bronaws Cupro-Alu	25-28	\$3-57	0.1-0.15	0.00-0.12	56-63	70-78	0.2-0.25	0.15-0.2		Calcul	

Figure 11: Example of automated calculation of cutting parameters in milling (Surfacing)

	Matières		Outil ARS	Outil ARS	Outil ARS	Outil ARS	Outil CM	Outil CM	Outil
	-		Vc (m/min)	Avance par tour pour L=3	Avance par tour pour L=6	Avance par tour pour L=12	Vc (m/min)	Avance par tour pour L=3	
	Acies	rs au Mn+S		0,05	0,08	0,1	135-150	0,15	0,20
	Acies	rs au Mn+S	34-38	0.05	0.08	0.08	105-120	0,15	0,20
	Acier a	u C ≤ 0,25%	32-36	0,05	0,06	0,06	105-120 80-90	0,15 0,15	0,20
	acier a	u C ≤ 0,45%	25-28	0,05	0,05	0,05			
Acier au C 5 0.65% Acier au C 5 0.65% Acier au C 5 0.99% Acier alliés 5 5 au Cr-Mo Acier alliés 5 5% au N1-Gr Acier alliés 5 5% au Cr-Mo Acier alliés 5 5% au Cr-Mo Fontes Forti-Perlit, FGL300 Fontes Fert-Perlit, FGL300		18-20	0,04	0,05	0,04	63-70 54-60 72-80 58-65 54-60 54-60	6,10 6,10 6,10 6,10 6,10 0,10	0,15 0,15 0,15 0,15 0,15 0,15	
		16-18	0,04	0,05	0,04				
		23-25	0,05	0,06	0,06				
		16-18	0,04	0,05	0,04				
		14-16	0,04	0,05	0,04				
		14-16	0,04	0,05	0,04				
		36-40	0,015	0,20	0,20	105-115	0,30	0,35	
		18-20	0,10	0,15	0,10	63-70	0,20	0,25	
	Fantes Pe	rlitione FGI.400	14-16	0.10	0.08	0.08	\$0.56	015	0.70
AR Ma	S CM	Acier au C≤ (),65%						
Vc		20	m/mn	D 20 mm					
fz	(L=3)	0,04	mm/tr			3885: mm/mn			
fz	(L=6)	0,05	mm/tr	s 318,4713: Tr/		2356(mm/mn		Calcul	

Figure 12 : Example of automated calculation of cutting parameters in turning (cutting)

V. Conclusion

A statistical study has been to highlight the differences and incompatibilities between the addresses of the various commands. We find that 62.50% of the addresses using one or two appointments, while the remaining addresses, or 37.50%, using four to nine nominations. This study could be used as a criterion of choice of material depending on the desired goal.

About a third of the addresses do not change regardless of the order designations used. The syntax for writing a block of program database used for the development of an adaptation module of machining instructions

To help the programmer to develop a machining program in different order, a tool was developed. This tool has several functions. The first function is to seek designation of preparatory functions after selecting the command "/ operation" and "G-code" and axillary functions. The second function allows the identification addresses with writing syntax desired codes. The third function processes Automation of various cutting parameters. The fourth function is devoted to the simulation of machining programs.

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