

MECHANICAL DESIGN: RELATIONSHIP BETWEEN FUNCTIONAL SEMANTIC AND GEOMETRIC DOMAIN MODELING FOR PARTS

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***Abstract** The functional relationships definition is linked with the product physical functionality in order to get users' needs satisfaction and consequently the requirement defined by product global function. There is a genetic terminology transmission polymorphically through the product functional hierarchical tree. So, to get parts and components geometric relationships should be take in account the appropriate functional model elaboration that translates the product external and internal customers' aspirations and needs. A linguistic model representation is necessary to defined two kinds of terminologies present in this process: first, to explore the functions descriptions and, second, to analyze conceptual and geometric definitions terms used in the mechanical design from designer. We suppose that there are relationships among the product parts functions several and that those functions can be represented by hierarchical functional structures. Those hierarchical functional structures can be defined and mapped in each product physical level. It is possible to define and modeling the functional descriptions terminology genetic inheritance and to do its correlation with the mechanical design technical terminology established as semantics associated with the geometric operator in the CAD system.*

Keywords: Mechanical Design Language; Function – Form mapping; Technical Terminology.

1. Introduction

The part role in the design process should satisfy the product global function definition. Its role is inherited from the conceptual design and preliminary design process, following Paul & Beitz (1997) model. So, parts are the final geometric embodiment and engineering in product design. The functionality relationships definition is linked with the product physical requirement in order to get users' needs satisfaction and consequently the product global function.

Observing the product functional tree, is written an inheritance mechanism is present from their components functions definitions. There is a genetic terminology transmission polymorphically through the product functional hierarchical tree. In the functional domain functions definitions are got by using the designer language and its semantic contexts. Obviously, that a linguistic model representation is necessary to defined two kinds of terminologies present in this process: first, to explore the functions descriptions and, second, to analyze conceptual and geometric definitions terms used in the mechanical design from designer.

This paper intends to present proposals to answer the questions observed: (1) Is there relationships among the product parts functions several? (2) Can those functions be represented by hierarchical functional structures? and, (3) Can the hierarchical functional structures be defined and mapped in each product physical level (product, assemblies and parts)? It is possible to define and model the functional descriptions terminology genetic inheritance (morphology, semantics, syntactic). And its correlation with the mechanical design technical terminology may be to establish as semantics associated with the geometric operator in the CAD system. The choice of the most appropriate geometry will be by non-functional requirements verification as manufacturing, assembly, cost, use, maintenance and discard. Such requirements should be considered through correlation among design specialized rules. That can be inserted through an object-oriented database associated, supplied with design requirements.

2. Research background

Several researches has studied the linguistic processing context applied to the industrial product design Prabhu et al, (2001) have used natural language processing (NLP) techniques to process textual callouts and to interpret information related to part/feature function and related processes. After all, the recognized part information is represented using object-oriented paradigm (OOP). It becomes suitable for linking to the downline CAD/CAM activities of the product cycle. Thus, the system provides effective alternative for automation design using CADD (Computer-Aided Design and Drafting) models.

Fernández & Serrano's (2000) reinforce that any natural language understanding system has as a generic goal to translate a source representation into a final representation that will be integrated in other systems with special functionality. The development of these systems must take into account aspects like: what *features a CAD* system must hold? What texts types are in system? Which functionality is required? What is the knowledge system to perform its functionality? Such questions have to be answered through the life cycle phases of a *NLP* system (analysis, design and implementation). Any systems that include *NLP* technology have complex, heterogeneous and interdisciplinary knowledge (several linguistic and non-linguistic description levels). Moreover, the uncertainty and variability of knowledge must be handled. Those features require a suitable conceptualization capable to interact with both expert linguists and developing one's.

Bertziss (1997) has developed a set of guidelines for the writing of natural language requirements for information systems. The guidelines are proposed to reduce ambiguity. The author shows a library of pattern to support to build quickly a new information systems. Also, all development process for information systems are based on this library. He still suggests that patterns have to be defined in both natural and formal language for the specific reasons of understandability and exactness.

Perez-Carballo & Strzalkowski (2000) present some details of natural language information retrieval system consisting of an advanced *NLP* module and a “pure” statistical mechanical core. While many problems remain to be solved, including the question of term-based representation of document's content, they attempted to demonstrate that their architecture described is nonetheless viable. In particular, they have demonstrated that natural language processing can now be done on a fairly large scale and that it's speed and robustness has improved to the point where it can be applied to real information retrieval (*IR*) problems.

More recently, Ashby (2000) reinforce there is a triple dependence in the product design process among function, material and geometry in the product manufacturing adequate process search. This implies in the assembly and manufacture parameters. The correlations among those elements are represented symbolically in the Fig. (1).

Important projects devoted to the definition of linguistic dictionaries started at the end of the 1980s in many research laboratories, but the dissemination of their results remain limited to a specialized community. The integration of databases and natural language has been for a long time a marginal topic for which only some research has been done.

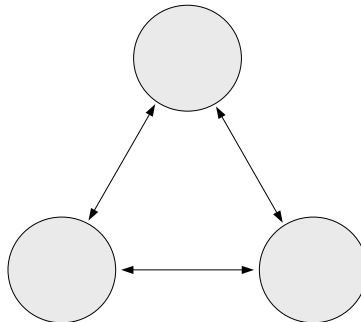


Figure 1: Three basic elements of the product design process, (Ashby, 2000).

Like language grammar, the search of parts geometric shapes may be driven by adequate grammatical structure based on the necessary functions that describes the product functional structure. So, it implies to find how designer semantics - the designer natural language (*NL*) - can be converted to syntax, or more precisely the translation of design requirements, and its constraints to form a grammatical sentence. Parts may have its undesirable effects in a limited range of values. As much the undesirable effects as the part design constraints can be rigid or loose depending on the application type. So, any part design should satisfy its functional requirements with the minimum of undesirable effects. Material and geometry has to be specified. Material definition is very difficult of being formulated by equations and the designer has to use his/her background to perform the task. Part geometry can be defined parametrically, but some parts need more information that single set of geometric parameters. Parametric design can be represented by set of variables.

3. Conceptual and Preliminary Design Background

Part functional structure is a way to systematize the part required functionality inside of conceptual design. Part functionality can be fulfilled by some dozens or more geometric configurations, since the geometric domain is always very large in design application. However, to choose part geometric shapes to perform functions established in conceptual design is always very difficult to define easily. Various restrictive constraints have to be specified to

fulfill product functional structure definition. Also, to find the final shape and specification of parts and product components demand more information than most *CAD* systems can supply nowadays.

The functional structure of each subsystem of product is presented in terms of realizable modules. Realizable modules (*RM*) is the result of functional and conceptual definitions to each product subsystems. It is the most deep element that a product can be broken in conceptual design. *RM* presents all functional characteristics that each part or component has to fulfil. All functional definitions applied to subsystems and product itself are extended to part design process. So, functional concepts applied to part design are achieved from the module realizable. Thus, each part present in the module realizable is structured in terms of part functional structure, part conceptual structure and part preliminary structure.

The *part functional structure* is a set of definitions that characterizes its functionality. It is based on its global function (*pGF*), partial functions (*pPF*), and elementary functions (*pEF*) (Linhares, 2000). Those functions are organized in a same similar way to the functional hierarchy product with levels and mutual dependency.

The *part conceptual structure* deals with spatial relationships among parts, including requirements and constraints that a part definition has to fulfill. Such structure includes: (1) part functional regions definition (*pFR*) that are the geometric space used by each part in order to satisfy the parts functional structure, previously defined; (2) part design requirements (*pDR*); (3) part design constraints (*pDC*). A design analysis has to be performed to relate the conceptual and functional structure.

The *part preliminary structure* means all preliminary data associated to the part shape and its final geometry. It can be viewed by producing sketches or even using parametric *features* from a *CAD* system. It is specified by a set of functional groups (*pFG*). To make easy to deal with *CAD* data, the part functional groups should be composed in terms of one or more parametric *features*. Some adjustments in the form can still be yet done later to the geometry to accomplish the set of one or more part functions.

Those three structures described above define a set of characteristics that a part has to accomplish to satisfy the definitions described in conceptual design and apply to preliminary part design. It involves to deal with parts functions and parts geometry.

In the last four decades researches has made a big effort to provide a formal description of the steps of design process. The description of Pahl & Beitz (1988) to model of product design process has been universally accepted and used in this paper. They model the design process hierarchically, like flow diagram that comprises four main phases: informational design, conceptual design, preliminary or embodiment design and detail design. Each phase can be split in substeps, and interactions among phases has to be performed in order to optimize the development of the final product.

The product specification is investigated in the informational and conceptual phases ending in a global function of product definition. Then, the global function (*GF*) is broken in two set of subfunctions: partial (*PF*) and elementary (*EF*) functions. Those functions are arranged in product functional structures. This structure can be presented in different ways; there is no uniqueness to this solution. It is normally presented in tree form, where the leafs define the realizable modules of product, (*VDI 2221*, 1973). The embodiment or preliminary design phase is characterized by a translation of the product functional structures in preliminary geometric shapes. Both parts and components form a preliminary structure and a first draft shape of the product begins to rise. Here, the designer deals with global functions of parts and components. Also, the relationships among global functions of parts, of same part itself, and among elements is used and analyzed. The geometric appearance of parts, geometric shapes of subcomponents, basic dimensions definition, and materials involved, as well its dynamics interaction, are considered.

In the end of preliminary phase the product design are ready to be detailed, if all design constraints, users requirement and design requirements were fulfilled, the product design are ready to be detailed. Also, designers have to transform product definitions, requirements and constraints into raw geometrical shapes. In the other words, they need to shape all verbalization inside product functional structures, translated in realizable modules. Here, it appears questions about how to deals with embodiment of parts that satisfies product and components concepts defined in prior phases.

4. Function description terminology (*FDT*)

Some authors have shown specific details about the development of part design. They have discussed about how part design has to be created: one understands that the part design definition should be in the preliminary design phase. Others, like Mortensen [09], consider that parts should be totally embodied in the detail design phase. He considers that besides functions, other necessary characteristics to part as form, dimensions, superficial quality and material are need to be specified to have the part functionality totally accomplished.

Mortesen papers reinforce that there are strong mutual influences among several parts and organs, during part design. It needs establish relationship between them, so that the design can be better managed. The specification of the part functionalities helps to find the domain of product design theory. That is, to get a complete functional

pattern of reasoning to define since individual parts to great mechanical systems. In other words, parts deliver functions to organs subsystems, which deliver functions to the product and vice-versa.

A classification of functions for mechanical design is studied by Kirschman and Fadel (1998) that includes both functions-based taxonomy and generic forms. The taxonomy is based on four groups of basic functions: motion, control, power/matter and enclose. A generic form is associated the description of a component or assembly to characterize the inputs and outputs to the form, but it doesn't consider how the input is converted to the output. A computational tool was developed that supplies the designer options of descriptions in geometric forms corresponding to the functions at the level of assemblies but not of parts separately. Methodologies investigated foresee that the product functional structure resolution should define alternative solutions in the form of realizable modules, in the end of conceptual design. However, after the product and its realizable module conception, there are no tools to help the designer to use it in the preliminary design process. It is not include in the later modern *CAD* systems. Also, there is no convergence between several approach of product design process about how to integrated conceptual design phase and the preliminary and detail design phases. In that two phases the embodiment and part final definition has to be finished.

Because of the great terminological diversification generated in mechanical system design domain and the different meanings between technical terminology inside and outside of *CAD* systems is necessary a minute and systematic study in the two domains modeling. Really, the success between linguistic correlations of those terminologies will be depends the correlations between functional structures and the geometrias that can carry through them in the product.

The main approach is to find a set the pattern used in conceptual design that can be understood and translated in the designer language. Designers communicate by means set of verbalized patterns, typically grammatical expressions defined in a specific domain of application. The designer expresses his intentions through semantics, whose syntax are common in the design environment. It can be used as data to the part design definition, including all functionality present in realizable module. The functions description can obey the inheritance observed in the functional hierarchic representation of the subassembly functional structure as shown in Fig. 2 and Fig. 3, for example. It is showing the subassembly functions broken up until the elementary functions level, those that will origin the parts that compose the subassembly. It is obvious that necessary to develop a computational systems to help designer to deal with data and information in the interface between the conceptual design phase and the preliminary design, is necessary. The general idea is establish two pattern terminologies so that the computational processing can be possible: first, to explore the functions descriptions and, second, to analyze conceptual and geometric definitions terms used in the mechanical design from designer.

It means, all verbalization inside product functional structures, translated in realizable mechanical modules, has to take forms or shapes that satisfy product design requirements. And so, parts have their shapes and design information attached.

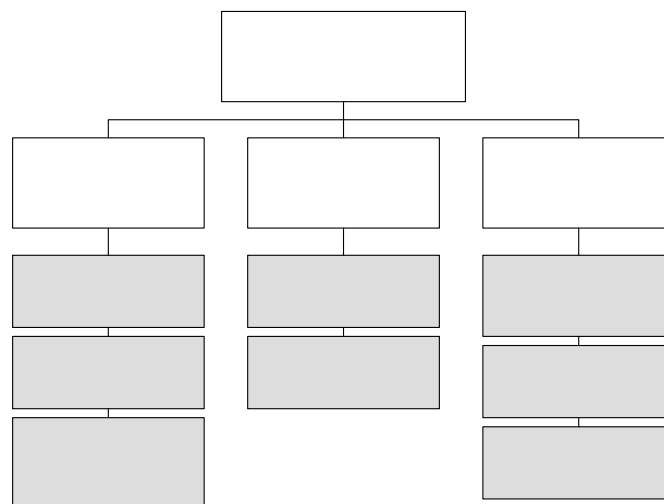


Figure 2. Subassembly functional structure: “mechanical transmission and lubrication system” of the alternative compressor, (*EGSHLP80* compressor, granted by *EMBRACO* – Empresa Brasileira de Compressores S.A.)

In the product design process systematization the researcher trends to study the inherent details to the some modules of study considering the phase's interference immediately previous and posterior, respectively by interdependences that they possess. The option to break up and posterior systematization of the activities and necessary procedures to product design process phase each context is developed in the process computerization direction. This always aims the quality and solution alternatives analysis improvement for the product and intensifying itself it the measure where the innovation going to time periods very shorts because the product customers and users emergent requirements. That requirements are presented constantly sped up in the industrial community.

The design intent can be expressed by product, assembly, subassembly or part functional structure description. If the part will have its functional structure broken up such as the complex product, its functionalities so will be unfolded thus that designer to be able to define with *CAD* system aid what geometries are better to each part functional regions and still what geometric features are better in each part functional region form composition.

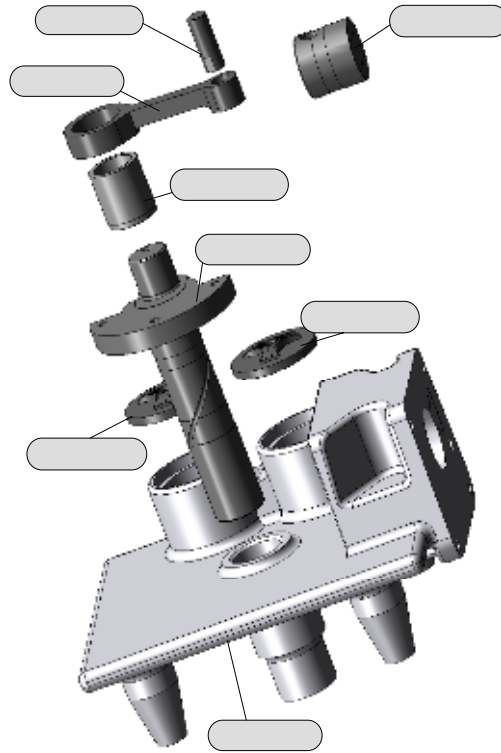


Figure 3. Subassembly physical structure defined from functional structure showing in Fig. 2, (Modeling in *Solid Edge* (2003) by Cesconetto, L. A. C., - *LabCADCAM – UFSC*).

5. Hierarchical Relationships Between Functions

The relations among functions that compose the functional structures in any physical level during the behavior in use are directed to product global function accomplishment. These relations can be established with bigger clarity in the conceptual and preliminary design phases, when is made the functional deployment in the assembly, subassemblies, parts, functional regions and geometric features levels, (Linhares, 2001).

Currently, we are deployments the functional structures of each product solution principle in as many functional structures as how many will be necessary until the each part functional structures definition. It is possible to deployment the part functional structure until the geometric feature level that are used in its *CAD* system geometric modeling. Thus, to establishing in this way the last product functional level, (Myung & Han, 2001, Linhares, 2002). The geometric features functional deployment can be represented by product physical structure model characterized by assemblies, subassemblies and parts in *CAD* systems as shown in Fig. 4 and Fig. 5 by *UML* (*Unified Modelling Language*) representation.

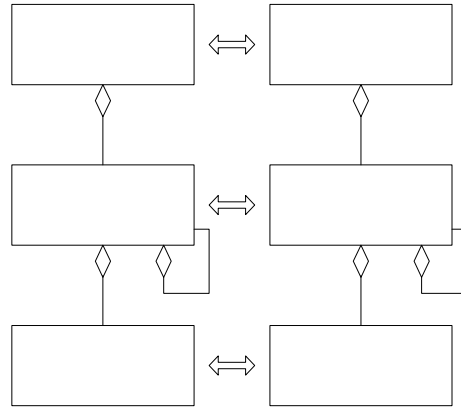


Figure 4 – UML (*Unified Modeling Language*) representation of the product physical and functional models.

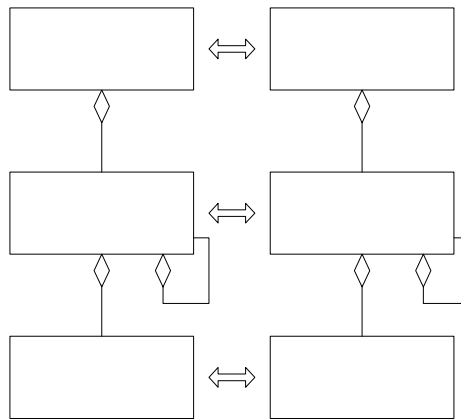


Figure 5 – UML (*Unified Modeling Language*) representation of the part physical and functional models and its hierarchical physical levels respectively into geometric feature level.

The solutions for the functions accomplishment in any hierarchic level can be defined from a *CAD* system during correlation with the corresponding geometric solutions. So, based in functional and physical representation model from product to geometric feature level the aspects that have relation with assembly operations can more easily be considered in made to “*product layouts*” definition in the preliminary design.

6. Genetic inheritance modeling

The genetic inheritance of the functional descriptions can be modeled by means object-oriented paradigm (*OO*). With base in the section 3 argument, we defends that an elementary function in any hierarchic level inherits of the function of immediately superior level some important elements for its definition. These elements are: function basic descriptions, design meanings derived from the global function, design intents, and so on. Using the object-oriented concept, the linguistic attributes reusability based in word semantics, syntax and morphology, the design intentions and meanings can be implemented by means of the Java language, for example.

7. Function-form mapping in cad system

So that the correlation among function description terminology (*FDT*) and technical terms pattern terminology (*DTT*) happens satisfactorily inside and outside of the *CAD* system, the processor development that to management the information stream between user (designer) input interface and *CAD* system kernel, is necessary. This can be made by expert system (*ES*) or another artificial intelligence system (*IA*) available during this proposal development.

However, only the geometry availability from *CAD* system that can effectively carry through one given function is not enough to guarantee the design quality. This will only be reached by means of analysis shell through which can be analyzed the design requirements dictated by product design specification (*PDS*). This requirements must be

considered on account of the cycle of life product later phases as manufacturing (manufacture and assembly), tests, use, maintenance and discarding.

8. Mechanical design technical terminology (DTT)

As emphasized previously, the function to geometry transition computational processing requires the functional descriptions mapping accomplishment its corresponding geometries. That implies in the terminology definition to support the functional mapping (semantic, syntax and morphological) and a terminology to geometric features and part functional regions identification for the (3D) solid geometries generation in the CAD system.

Thus, to compatible geometric forms recovery to accomplishment all product, assemblies, subassemblies and parts requirements functions starting from CAD system geometric features libraries, the correlation between functional description terminology and the terminology that can characterize and identify these computational components, is really necessary. In the CAD system, each geometric detail that generate a part by means sketches elaboration must have the characteristic name. The proper sketch or profile must have equally a possible name that can identify it among a big diversification of the sketches during the part geometric modeling execution as well as the parts used in one determined product domain.

This terminology will go to generate the characteristic language to be used in product design process in the application domain that uses a CAD system. This implies that the terminology used in the attribution of geometric details names as groove, dash, cavity, hole, chamfer, furrow, etc., must be such that its identification is possible by syntactic and also computational reading.

The terminology computational identification in each detail, term, sketch, feature, functional region or part is necessary to semantics correlation between functions and those geometrias required for its accomplishment and vice versa. Therefore, the terminology study and development compatible with a characteristic product domain must be carried through for this linguistic and semantic mapping.

With the identification and the definition of the more important geometric and semantic parameters of these each elements (detail, term, sketch, feature, functional region or part), will be possible to more quickly search the compatible geometrias in CAD system that can carry through the intentioned functions by designer when he/she to come across with a part functional structure.

This study requires, initially, the survey of the terms more used in the main generating geometric entities identification of the CAD system functional solids and surfaces in application domain of one determined Language, for example, Portuguese, English, etc. When the way to correlate the part functions will be established either in the global, partial or elementary level with parametric geometries that can effectively carry through such functions, the designer will be able to visualize the corresponding geometric object to itself intention in design real time. This computational operation, carried through among the function description semantic level and the system CAD geometric level in the way as it will be carried through, will have to allow to the designer a bigger flexibility to search of solution alternatives to geometric features, functional regions, parts and assemblies in product design process preliminary design phase. In the beginning of the design object geometric modeling as a part, for example, are defined what loss level object can be recouped from a parametric profiles, geometric features and functional regions library or that they can be placed to the disposal or be constructed with CAD system resources in use. After that, these objects will have to be organized as cells. They will be generating elements of reusable geometric forms 3D in the mechanical design activity.

The complete organization of these cells is makes with the use of a compatible nomenclature to mechanical design domain, that is, we are searching to define a term or name structure associates to all functions product, assemblies, subassemblies, parts, functional regions and geometric features that can support in the real world the functions accomplishment. The terminology proposal and identification will allow the "identification terms" definition of the each geometric entity and its respective characteristics, or attributes.

Three kinds of definitions are proposal for each mechanical design technical term: a conceptual definition, a geometric definition and a nomenclature definition. An example is the "groove" term case. What the meaning of "groove" in the part mechanical design? Where is it conceptual, geometric and nomenclature definitions?

(a) **Conceptual definitions:** semantics, meaning, synonymy, etc.;

(b) **Geometric definitions:** associated parameters, graphical representation, common elements, geometric and dimensional constraints etc. What geometric construction elements are necessary in the its definition? For example: sketch + how many operators or 1 profile + how many operators?

(c) **Nomenclature definition:** term, symbol, English, Italian, French, and so on, translation.

A more usually used terms previous survey of the mechanical part design pointed to a considerable diversity between the terms and its respective meanings. In this propose, each technical term will have its respective design

general characteristics associates to previous definitions. A practical example is given to follow for the term "groove".

8.1. "Groove" conceptual definitions

(a) Concept 1: It is an notch or rabbet made in the part body in the longitudinal direction; Place where one will be inlaid one protusion in the part symmetrical axis direction.

(b) Concept 2: Place where another part with one protusion, can be dislocated as a sliding one, in the part symmetrical axis longitudinal direction.

(c) Concept 3: The groove must start and finish with a same transversal section or a section plane projection and must be completely longitudinally leaked.

(d) Synonymy: Chink, split, crack, cleft; fissure, sulcus.

8.2. "Groove" geometric definitions

(a) Associated parameters: All element whose value variation modifies the problem solution without modifying itself nature. In the mechanical design, they are geometric regions that characterize the term in its meaning such as: transversal section, perimeter, ray, width, length, section type (prismatic, not prismatic, mixing), depth, direction, geometric primitive (straight line, curve, etc.);

(b) Graphical representation: Representation by sketches of the different types of grooves;

(c) Geometric and dimensional constraints: A dimensional and geometric restrictions basic level will be established on which the term definition will be characterized. In the groove case, for example, parallelism, connection, etc., are more important in the profile or sketch definition. According the proposed, for example, a groove it will not exist at the moment where its width will be greater that three times its height ($b > 3h$), independent of the profile or sketch type used in the its generating, as shows Fig. 6.

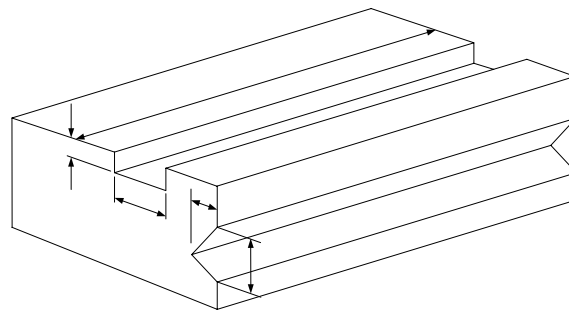


Figura 6. Groove croquis with triangular and rectangular profile.

(d) Geometric construction elements: The geometric construction elements to which we relate, in *CAD* systems, are the sketches (or profiles) and the geometric operators necessary to *3D* geometric modeling to a term during the part or geometric model construction.

So, the technical terms to which we relate are, in true, *3D* solids used in the geometric modeling during the part creation. This solid, in a posterior stage will have to make interface with others parts in the respective assembly or subassembly composition of the product physical realization.

However, is more important to define, for each term, which geometric construction elements could be probably used in its geometric modeling. In our example, we can define, a priori, that the kinds of sketches shown in Fig. 7, can be used.

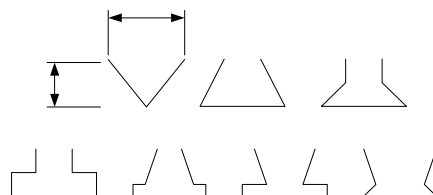


Figura 7. Probable sketches (or profiles) to groove geometric modeling in *CAD* systems.

In Table 1, the probable operators are shown to will be used in the 3D geometric modeling during the groove creation from sketches (or profiles) shown in Figure 7

Tabela 1. Probable operators used in groove 3D geometric modeling.

Sketch-based feature generation	Profile-based feature generation
Protusion	Cutout, Revolved Cutout, Swept Cutout, Lofted Cutout, Helical Cutout, Normal Cutout
Revolved Protusion	
Swept Protusion	
Lofted Protusion	
Helical Protusion	

8.3. Function-technical term correlation

Much more important that dimensional constraints of the solid generate sketch that defines a term technician (groove) is the dimensional restriction of this sketch in relation to the part as a whole where it is being created. According we proposal, this is a basic factor in the modeling, because associates functions with each term are determinative in the part functional regions modeling that are resulted of the solid related ones.

The functions associated definition to technical term is the proposal base, because the design intention is processed in the mapping function → form direction. This is processed in the searching of the possible geometries supplied in the CAD system at the possible solutions for the part physical realization.

8.4. “Groove” nomenclature definitions

(a) Term: Text, word, single expression; Concept represented for its verbal expression; Expressing way; Form, writing, text; Each one of the fraction elements, a relation, a ratio or a progression; In the mechanical design it is the linguistic representation of the geometric entity desired or intentioned by designer. In this case the term is "groove".

(b) Symbol: Anything used to represent another one; Material object that serves to represent anything non material; Image, emblem, figure, mark, signal that represents anything; Image that represents and locks up the unconscious trends representation. In the mechanical design it is a linguistic description that represents a term, either geometric or not. The term "groove" can be represented for the symbols: “*gr, gro, groo, grv*” and so on.

(c) Translation: Act or effect to translate; Act of translate words, phrases or written workmanships of a language for another one; Image, consequence, repercussion; Explanation, interpretation. In the mechanical design it is interesting the technical term meaning from all Languages to all Languages.

Esse tipo de abordagem pode ser defendido por diferentes tipos de interpretações na grande maioria das Línguas, principalmente naquelas em que, usualmente, há uma crescente inserção de novos termos técnicos e não técnicos.

So, this approach can be necessary in the countries where the technical norms standardization to allow different types of interpretations in the majority of the Languages. It happen where there are a growing insert of new technical and non technical terms in the industrial environment.

9. General considerations

The feature based functional and geometric modeling only using commercial CAD system as design environment can to eliminate a large extent of the deficiencies presented in the process design final phases thinking in the product manufacturing, however presents some disadvantages:

- (1) It depends essentially on the designer experience;
- (2) It does not incorporate the knowledge representation process;
- (3) Don't present mechanisms to use certain knowledge types;
- (4) Its indexation, update and extension are more difficult;
- (5) It does not present a mechanism to interpret its results.

Therefore, has been developed modeling environment integrated with intelligent systems such as expert systems, neural networks (NN), Processing of Natural Language (PLN), logic fuzzy, and so on. Such computational tools can be used as data resources, evaluation analyses, graphs and training, as much process design as knowledge generation on account manufacturing.

In this paper a initial proposal for systematic development that integrates functional and geometric modeling by mapping of the two terminologies, was made. Under an architecture where databases with functional and geometric

information, intelligent system and *CAD* system capable to support product functional and geometric requirements of the product, they will be relate. A study of case will have to be carried through to base the proposal.

The objective is that proposal system can modify parametrically the feature, part functional region, part, subassembly or assembly that will be modeled by commercial *CAD* system keeping functional, dimensional and geometric integrity. Later, this can be also used as input for the product manufacturing assembly operations planning. The decisive key point is the product design specification requirements consideration during the choice of geometry more adjusted in all the product hierarchic physical levels that have implicit of some form, the dimensional and geometric restrictions.

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