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STRUCTURE OF DATA BASE FOR COMPUTER AIDED MANUFACTURING SYSTEMS

Summary. First in the paper the following fields of action were defined : planning for production, design, planning for manufacturing process, manufacture, and assembly . Next, Entity-Relationship scheme and structure of data base for computer aided manufacturing systems were presented.

1. Entrance

In computer aided manufacturing systems several fields of action can be defined: planning for production, design, planning for manufacturing process, manufacture, and assembly [1].

The aim of planning for production is establishment of manufacturing courses and manufacture timescale, load of work stations, planning for materials, etc.

Design department activity concentrates on preparing a draft for products and as a result design documentation is generated. This design documentation is indispensable for the next production stages.

Process engineer's field is preparation of plans and instructions for manufacturing processes and operations, in particular selection of various elements for manufacturing process: (machine tools, manufacturing equipment, tools, tooling machine tools, manufacturing parameters, etc.). Design of programs for machine tools and numerically controlled manufacturing equipment is also the process engineer's task.

In the field of manufacture, computer manufacture control can be divided into three groups: immediate control of individual manufacturing machines and autonomous machining stations, higher control of minisystems composed of 2-3 autonomous manufacturing machines as well as higher control of more than 4-5 manufacturing machines. It can be observed that CNC system's software controls the functional activity and processing programs control the manufacturing activity. Every field of action is characterized by a specific information flow. The integration of information and

data flow in particular fields (departments) of manufacture is a very important element for computer aided manufacturing systems.

2. Data organization in a company

Data perform more and more crucial role in the proper functioning of a company. Data organization in a company implies to two main flows:

- data flow concerned with product (form geometry, physical and processing features)
- management and administration data flow concerned with organization and production beginning with the order of product's execution to its storage.

In the computer aided manufacturing systems data are organized in such a way that the data change between systems is possible and that access to the data on particular manufacturing stations is available.

In a company three basis groups of entities can be specified: orders, products and manufacturing means.

The order answers the question: what kind of product , when and in what quantity is to be manufactured.

All the data which describe product: its structure, geometry, material and manufacturing data, as well as manufacturing course indispensable to execution together with the data concerning product's performance and product lifetime are assigned to product model.

Manufacturing means include the data, which describe production possibilities of a company (machine tools, tooling machine tools, productivity).

3. Place and role of data base for computer aided manufacturing systems

Computer aided manufacturing systems must be able of processing data of different format and size. Currently multimedial data base are being created, which allow on transfer of text descriptions, graphic data (figures, tables, sketches) and data in the form of pictures, sounds, and animation. An access to the data also for the purpose of possible changes must be efficient. Different data structure and time of data processing are required in different steps of manufacturing process . All the requirements concerning data base in manufacturing process can be defined in the following manner "the proper information" in "the proper places" in "the proper time" and in "the proper form" should be at the disposal so that "the proper decisions" are taken. In order to meet those requirements data base systems are used. Requirements concerning data base systems in computer aided manufacturing systems are defined by information types in particular manufacturing fields, data characteristics and their number and required criteria. The required criteria are different for different manufacturing stages accounting for the whole data base . The required criteria comprise: independence from user,

controlled redundancy, data physical independence, integration, data security, availability to data use, possibility of similarity search, new data integration and varying access frequency.

Conventional data base systems aren't sufficient on account of their adaptation for particular receivers and their dependence on the implemented operating system.

However, the data base systems which can serve many users at a time and enable concurrent availability to the same data, are useful. All the data included in the data base, which are logically bound with one another, occur only once and can be accessible for different processing programs. In the case of integrated data base there is a possibility of quick comparison of orders and possibility of use of the earlier orders needed to work out a quick offer while considering costs, terms, etc [2].

Data base system permits on addition of new information, modification old information, and search for information and data needed for the proper selection of manufacturing process.

Moreover the important role of data base is:

- possibility of dynamic selection of information on the basis of design, manufacturing and functional requirements, interactionally specified by user
- automatical generation of elements
- multialternative calculations
- project records storage for the purpose of repeated use
- possibility of storage of the entities in the parameter form
- possibility of display of characteristics in the graphic, and tabular form.

4. Idea of Entity-Relationship Scheme (E-R) for computer aided manufacturing systems

On the one hand this model is a result of a certain abstract process of grasping data in real word, and on the other hand data which were memorized in computer are referred to in the entity-relationship model. This model is intended to create a conceptional model of an object domain. In object domain there are objects, these objects remain in certain relationships, the objects as well as the relationships can possess attributes (features) which belong to defined files of simple values. Relationships are furnished with labels. There are the following types of labels: 1:1, N:1, 1:N, N:N [3].

Entity-relationship scheme for computer aided manufacturing systems is presented on fig. 1. There are following entities: planning for production, design, planning for manufacturing process, manufacture, assembly and relationship between all those entities. Entities have attributes, which display features of particular stages for computer aided manufacture.

Planning for production attributes concern manufacturing courses and manufacture timescales, load of work stations, planning for materials, etc.

Design attributes include features concerning product geometry and data needed to generate design documentation.

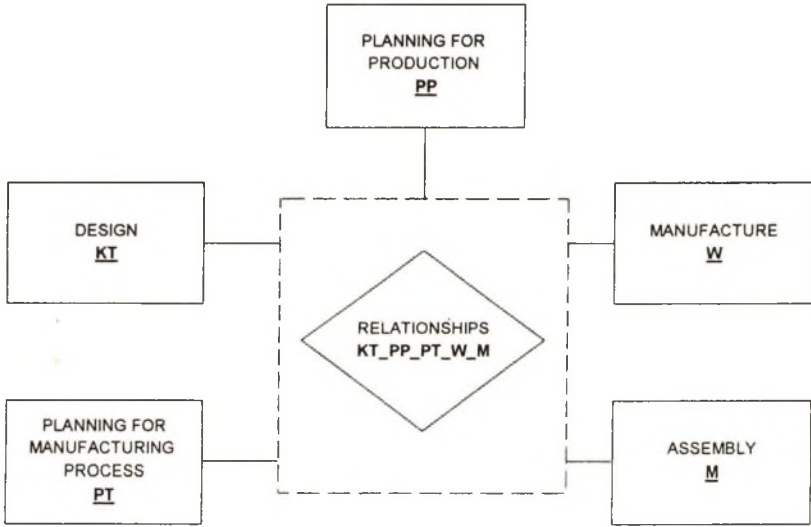


Fig. 1. Entity - Relationship scheme for computer aided manufacturing systems

Planning for manufacturing process attributes include data concerning plans and instructions for manufacturing processes and operations, especially the selection of different elements for manufacturing process (machine tools, manufacturing equipment, tools, tooling machine tools, manufacturing parameters, etc.) and programs for numerically controlled machine tools and manufacturing equipment.

Manufacture attributes include information about elements and products manufacture .

Assembly attributes include data concerning manner of assembling elements into a ready product.

5. Data base structure

Analysing scheme E-R a conclusion can be drawn, that particular fields for computer aided manufacture use data base presented on fig. 2.

In planning for production field the computer aided manufacturing system uses the following base: orders, planning for production, materials, semi-finished products, machine tools, tooling machine tools, tools, ready products.

In design field the system uses the following base: materials, semi-finished products, design documentations, machine tools, tooling machine tools, tools, manufacture documentations, ready products.

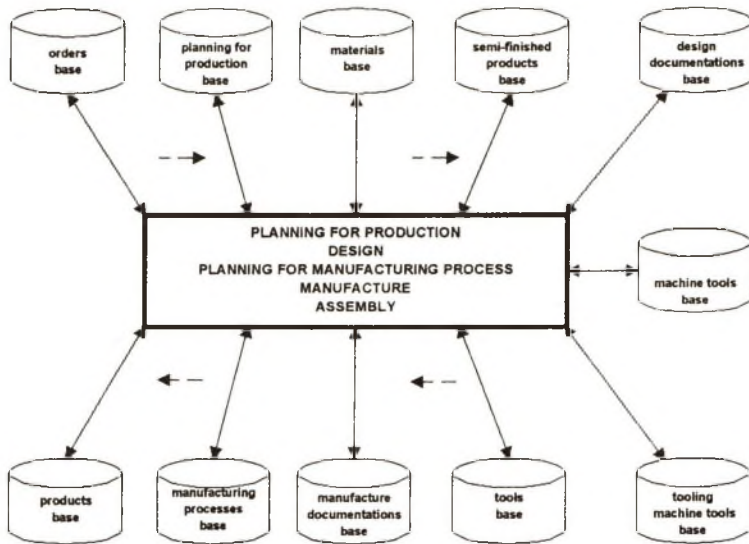


Fig. 2. Structure of data base for computer aided manufacturing systems

In planning for manufacturing process the system uses the following base: materials, semi-finished products, design documentations, machine tools, tooling machine tools, tools, manufacture documentations, manufacturing processes, ready products.

In manufacture the system uses the following base: design documentations, machine tools, tooling machine tools, tools, manufacture documentations.

In assembly the system uses the following base: design documentations, manufacture documentations, ready products.

Data base include information of different type, format, importance. But all the pieces of information are needed for the correct functioning of computer aided manufacturing systems.

Orders base includes information characterising product, term of its execution, planned number of product pieces, etc.

Planning for production base includes information about number of pieces, series size, lot size, priority of operations execution, machine tools load and elements' reserve.

Materials base includes information about the name of the material, physical-manufacturing qualities, quantity, price, etc.

Semi-finished products base includes following information about material, of which the product was made, overall dimensions, parameters, hardness, quantity, price, etc.

Design documentations base includes information about product's geometry, classification, accuracy number, special requirements, etc.

Machine tools base includes such information as name, type, producer, power, parameters, unit cost, etc.

Tooling machine tools base includes information describing characteristic features of tooling machine tools, machine tools, unit cost, etc.

Tools base includes information about types of tools, their characteristic features, intend for operations, unit cost, etc.

Manufacture documentations base includes information about processing plans, selection of machine tools, tooling machine tools and tools, processing parameters, processes software, costing, etc.

Manufacturing processes base includes information about manufacturing processes.

Products base includes information about the name of the product, order number, cost, etc.

Computer aided manufacturing systems use data base. Very important is creation of the correct data base structure, what certainly will enable an earlier formulation of E-R scheme. Moreover, the competent and productive data base system management is the condition of effective data base use. The proper management system depends on the selection of the right tool for the programming of the data base system.

References

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