CAD systems for design and examining of automated technique

Vania K. Georgieva[1], Dimcho S.Chakarski[2] and Tatyana A. Andonova-Vakarelska[3]

Abstract: ***There are multiple objects in the discrete production being subject of automation; differing in shape, mass, dimensions, materials, lot size, technological process, operation's time, technological units etc. Every different solution has its own specifics. Nevertheless the variety present - it is possible to standardize them on the basis of a unified approach to automation of a discrete production.***

In order to optimize the activity of designing an effective solution for automated technique a CAD system is needed.
A model structure of a CAD system for automated technique of a discrete production design and analysis is presented in the paper. The main program modules and menu types are examined. Special attention is devoted to building the database.

Key words: automation, automated technique, a CAD system, projecting, examining.

I. INTRODUCTION:

The discrete production has a range of specific features: the huge diversity of the applied technologic processes, the industrial machines and appliances. The requirements towards the accuracy in the production of the details are huge. For every particular case an enormous count of solutions is possible and this makes very difficult the choice of the most suitable variant for a certain object with correspondence to the set requirements. The seriation of the production is also different; the discrete production of batch and semi-batch character is predominate. The automation imposes the formation of technical means with high productivity and represents accelerated and general implanation of scientific and technical progress in the manufacture. The automation of the manufacture holds the following tasks - an increasement of the efficiency of people's work while increasing its effectiveness. It leads to a new approach and a new vision, reveals big possibilities for positive changes in the part and the function of the person, in the ease of the work, and a change in its character and in its intellectualizing.

The automation is not a concept of a set of technical means but an all round process in choosing the most perspective directions for development, and improvement of the production, the creation of progressive technologic methods and processes, technical means and organizational forms and systems for control.

[3]Tatyana A. Andondva-Vauarelska is with the Faculty of Mechanical Engineering, boul. "Kl. Ohridski" N8, 1756 Sofia, Bulgaria, E-mail: tvakarelska@abv.bg

[2] Dimcho S. Chauarsky is with the Faculty of Mechanical Engineering, boul. "Kl. Ohridski" N8, 1756 Sofia, Bulgaria, E-mail: adp@tu-sofia..bg

[1]Vania K. Georgieva is with the Faculty of Mechanical Engineering, boul. "Kl. Ohridski" N8, 1756 Sofia, Bulgaria, E-mail: vkib@abv.bg

The automation is a powerful means for completing high technical economical indicators of manufacture, while receiving enough quantity of production, achieving growth in industrial produce and improving the vital standard, improving the competitive power of the production, a concern for the environment through the usage of non-scarps technologies and more.The information technologies will develop more and more together with the computer techniques in the whole cycle "examination-projection-production-marketing". The task of the development is to present a structure of a CAD system for computerized projection and examination the work of the automated techniques as choosing the suitable graphic surroundings.

II. CLASSIFICATION OF THE AUTOMATED TECHNIQUE AND TYPES OF TASKS ON AUTOMATION OF THE DISCRETE PRODUCTION

TABLE.I.
CLASSIFICATION OF THE AUTOMATED TECHNIQUE.

Automated technique					
Automated Devices	APM (technologic units)			RTM	Automated complexes
Orientate	Processin	Montagin	Packi	Processing	Flexible
Hopper-type	Mechanical-	Helix-	Proportioning	Dyeing	AC with a hard jointp
Storage-type		Screwing	Foil handing	Hot sticking under	AC with a flexible joint
Transported	Forge-	Pressing		Under pressure	FAMS
Manipulative	Pressing	Askingи	Sticking	Point-welding	Automated sections
Fixing	Welding	Point-	Other	Arc-welding заваряване	Automated departments
Based on and	Founding	Welding		Montage	
Embedded	Them-processin	Flattening downaщи		Packing	
Separatin		Other		Palletizing	
Collective Other				Other	

To complete the various tasks around the automation of the discrete production the automated technique is used. Its systematic conversance allows a qualitative approach when automating these production processes. The automated technique is a general concept that includes whatever techniques perform particular types of functions and operation i.e. this is the technique that ensures the automation of the manufacture. There is a variety of automated technique but four big groups can be differentiated: automated devices, automated production machines (APM), robotics technologic modules (RTM),

flexible production cells (FPC), automated complexes (AC).
On Table I is shown an exemplary classification of the automated technique when from every group are specified the respective types and varieties. One and same production processes can be realized by different types of automated technique.

While projecting and examining the automated technique can be distinguished the following basic types of tasks, regarding the type of the automated technique: marketing researches, prognosis, projecting, engineering, technical preparation, programming the industrial robots, programming the machines with CPS and the robotics technologic modules, exploitation, documentation, design and artwork, preparing export reports, making out offers and assignments for projection and more

For effective solution of the specified tasks the computer technology is used in most of the cases. Industrial packs are applied or specialized program systems. In Table.II. are shown the most used program-industrial packs.

III. POTENTIALITIES OF THE GRAPHIC SYSTEMS AND AREAS OF THEIR APPLIANCE.

Amidst the variety of CAD/CAM products, a practical role in the automating of the manufacture holds the listed in the Table.II. systems (listed alphabetically by the name of their producer company).

TABLE.II

Basic features of the leading CAD/CAM program packs

Company / Product	1	2	3	4	5	6	7	8	9	10	11
AutoDesk / MD Power Pack 5	S	S	S	0	S	S	S	P	P	S	м
Bentley / Micro Station	S	S	0	0	0	p	p	P	P	S	н
Dassault / CATIA V5	S	S	0	0	0	p	p	P	P	S	н
Dassault / SowidWorks	S	S	S	S	S	0	0	0	S	S	м
Matra Datavision / Euclid	S	S	0	0	0	p	S	S	P	S	н
PTC/Pro/Engineer 200i	S	S	S	S	S	S	0	P	P	S	H
Unigraphics Solution / Unigraphics	S	S	S	0	0	p	S	S	P	S	н

1. Surface & Ware frame - planes and netting;
2. Solid – hard modeling;
3. Automated generating of sketches;
4. Check for collisions when montaging;
5. Bifarious suggestiveness between the sketch and the 3D object;
6. A presence of libraries with standardized details;
7. An analysis using the method of the complete elements;
8. Programs for engineering calculations and interface programs;
9. Photo-realistic visualization of the projected articles;
10. Maintenance of WEB – appliances and possibility for sharing file formats; (S) uproot – support, (P) Arial – partially, (0) – no;
11. Class of the product (H – high, M - middle);

Marked are those features of the products in the range of the automated projection of mechanical articles. In the table we see the tendency among the leading companies which produce CAD/CAM products, towards unifying the systems. The main differences are in the prices and the variety of the offered accessory modules. All the specified systems for projection of mechanical articles have the potentialities to a bigger integration of the whole process from the projecting to the analysis of the article and the preparation of the production and their approach to the idea about the construction of an integrated product-information model.

Because of this reason every one of them is suitable for the tasks of the projection on the automated technique. But the biggest popularity among the constructors in Bulgaria holds the program Sowid Works. The choice is made mainly because of the following features: a presence of modules, including the whole process "projecting-producing", a presence of intuitional consumer interface with elements of artificial intellect, a presence of modules for projecting of specific articles such as ones made of sheet plate materials, plastic, die details and more, possibilities for assembling very complex articles (made of few hundred thousands elements), possibilities for different analyses of the details and the constructions as a whole (strain, temperatures, size chains and collisions in the unions and more) when generating the NC-programs, types of treatment and number of operated axes, a presence of graphic and other data libraries.

IV. STRUCTURE OF CAD SYSTEMS FOR PROJECTION AND EXAMINATION OF AUTOMATED TECHNIQUE.

On Figure.1. is given an exemplary scheme of the structure of CAD for projection and examination of automated technique while the scheme is open for accessory modules (program-calculated).

V. GRAPHIC DATABASE OF THE AUTOMATED TECHNIQUE.

Here are discussed the last tendencies in storage and reproduction of graphic objects as database in the range of CAD systems. These are the so-called technologies based on the features of the elements, which a specified detail is consisted of, a technologic process, or other object of the projection activity.

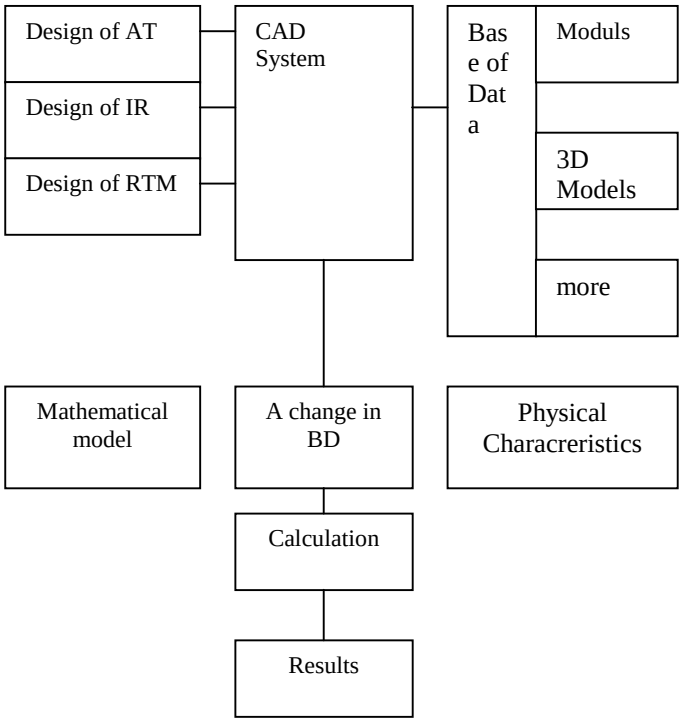

Fig1. Structural scheme of a CAD system

Most generally these database appropriate more knowledge (graphic, dynamic, technologic and more included) of these elements with an aim to get a higher state of integration at the separate stages of projection. On Figure .2. is given such an example: on the left side is shown an element of a geometric form together with its adjoining attributes. On the right side of the figure are shown the technologies which are necessary for the production of this element – a technologic route, the suitable for this case machines and instruments and so on. The parametric database that consists of rigidly shaped objects is constructed through the method of Fitcher's technology that was discussed above when the separate elements from which the model of the projected article is made, hold individual characteristics. From a point of view of the methodology, used by the producer, this is a method for construction, under which the volumetric model of already made elements (stored with their systematic features) are created first and then from it automatically is generated a sketch that is suggestively connected to the model. This means that if the model (respectively on the sketch) some changes are made (size and form of the objects) these changes automatically will be affected on the sketch (respectively in the model). This is shown on Figure .3. A vibrated hopper was given for an example as on Figure .3. is shown the suggestive connection between the sketch and the produced 3D element, and on figure .4. is shown the stiff bond between the diameter of the glass and the base of the vibrated hopper i.e. when a change occurs in some parameter in whichever part (left or right) on the figures, the rest is automatically transformed. This storage of data is called parametrical because the separate objects, from which the detail is constructed, are defined through a conscription of figurative and geometric parameters. Also this way produced models are called Hard making and they can be given and calculated material characteristic like when it comes to actual solid objects.

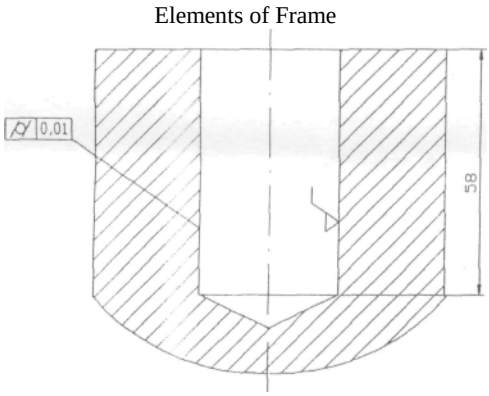

Fig. 2. Scheme of a technologic Feature (hallow hole)

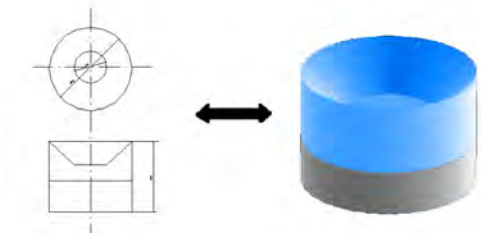

Fig3.Associativeness of the models, a) 2D model (sketch); b) 3D model)

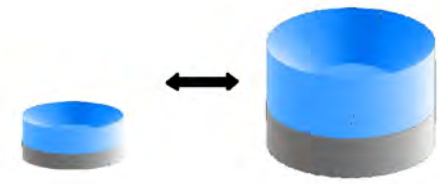

Fig.4.Geometric suggestiveness of the 3D model

On Figure .5. is given an example of storage of graphic database and a parametric access to it. On the figure is illustrated a pneumatic module that holds the features of a rigid object and it is 3D visual.

VI. Conclusions:

- A classification of automated technique is made and the characteristic tasks in the automation of the discrete production have been marked off.
- The possibilities of the graphic systems were analyzed and their features were marked off with a view to their application to the computerized construction of the automated technique
- CAD system of a principle has been given for projection and examination of A structure of a specialized automated technique while there is a connection to graphic surroundings

- A way for construction of a graphic database that is necessary for the realization of a specialized CAD system.

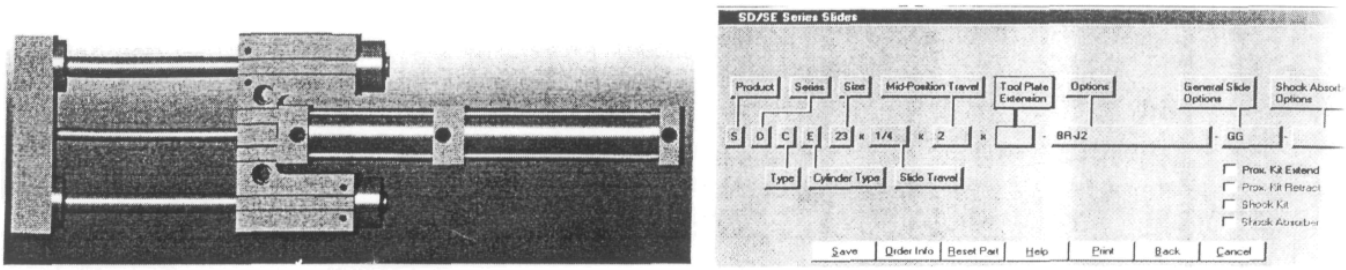

Figure.5. Graphic data bank a) module for translation – 3D, b) parametric access to the graphic database for modules of translation

REFERENCES:

1. Todorov N., D. Chakarski. Automation of the projection in the engineering, S, Technics, 1994
2. Donkov D., CAD/CAM systems in the engineering, A University publishing house, Gabrovo, 2001 eng. Ivo Mihailov Yanakiev
3. Georgieva, V. Typical Solutions for automation productional process of orientation parts. Scientific Nnewsletter of the Union of Mechanical Engineerings. Sofia, 2002.