Automation design systems for mechanical engineering and device node design

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Abstract. This paper is concerned to the analysis of the construction of the devices with software program for the engineering production. It is necessary to optimize the basic parameters of production for quality improvement. The important and modern trend is development of the program platform for useful and not very expensive software. The integrating program allows us to create new modules of the software for design devices. It was done the overview of the programs for analyzing the main elements of the individual parts of the construction devices for the modern control systems. It was shown that the idea of construction connected possible with integrated software system Trace mode. This product has module for design and investigation of apparatuses with new quality of elements. Concepts relating to design issues are interpreted by different approaches in international standards.

1. Introduction
An application of computer technology in the production process at the enterprises of mechanical engineering requires large financial investments. Therefore, the main purpose of the correct decision may be the right choice of the software platform for the production process on the plant. It is clear the main trend is the introduction of computer development in this way should be on the base of the most expensive software products for creation the new product solutions [1-4].

2. Methods of MSC for material in engineering
Nowadays the actual problem is the creation a laboratory of multiphisical modeling where the research will carried out with multidisciplinary tasks which using the full information about the object, including 3D, with the transmission in the network space, the attributes of a modern web-environment-chats, video and audio, 3D- animation (figure1-2), etc. There is much software designed for specific tasks, one of them named MSC Software. For example, programm MARC_MENTAT is product of MSC. Software provides a range of design solutions by calculating various design options for strength, destruction, etc. As based on the MSC Software has extensive software MARC. MENTAT, NASTRAN, RASTRAN.
Mechanical deformation of a flat bar with one fixed point at the imposed load (MARC program). Mentat - 2D model (figure 1).

Figure 1. Design of detail in 2D Marc_Mentat.

Figure 2. Design with profilers in Pro-Engineering.

Figure 3. Design with profilers in Pro-Engineering.

Figure 2, 3 show the design of a engine fragment in the Pro-Engineering design software. This program refers to the "middle core" of design, commutes well with lower-level programs, and is integrated into top-level programs such as NASTRAN, PATRAN, etc.

Look at the software MSC (for exemplar, MARC) design of the detail (figure 2-4). These are possible to design the fields of the thermal data block in nodal format. At this block this parameters varies with time, temperature, or some other independent variable. However contacting nodes encountered relative to an inactive body are allowed to penetrate, but if the body is made active again, penetrated nodes are ignored unless they are within the contact tolerance zone. In other word, motion may still Marc will map the results from the previous analysis to the new analysis model automatically for 2D to 3D under the. Marc will map the results from the previous analysis to the new analysis model automatically. The design has next steps: creation of the local (fine mesh) analysis model, applying loads and boundary conditions, then assign element and material properties to the new model. Set up and submit the job indicating the results file to use for defining boundary conditions of the previous analysis. The boundaries are defined by specifying connecting nodes from the local to the
global model. Super plastic Forming jobs requires a special pressure load applying across the entire surface area. This is an element variable pressure of arbitrary magnitude. By Marc it is possible to calculate energies for detail parameters with Finite Element application (FEA).

![Figure 4](image1.png)

**Figure 4.** Block in nodal format (FEA) - design in PATRAN.

The model is decomposed into detail of elements, where each element is part of one and only one domain. The nodes which are located on one part boundaries are duplicated in all nodes at the boundary. These nodes are referred to as inter-domain nodes below. The total number of elements is thus the same as in a serial (nonparallel) run but the total number of nodes can be larger. The computations in each domain are done by separate processes on the machine used. At various stages of the analysis, the processes need to communicate data between each other. This is handled by means of a communication protocol. Each machine (node) of a cluster can also be a multiprocessor machine. Marc also has matrix solvers which can perform the matrix solution in parallel while the rest of the analysis is serial. This program used solver that supports both shared memory machines and clusters. It uses different block program for the communication. The applied solvers support shared memory machines. These solvers can also be used with another program that cost is very much [5-7].

![Figure 5](image2.png)

**Figure 5.** Projecting the aircraft loads n MSC.

The modeling detail and process of detail design in program PATRAN on figure 5. The use of non-destructive control techniques to evaluate a project with the application of thermal loads and deformation tests of the structure. So, MSC Software is a partner of the Aerospace industry since 1960. Those programs allow making calculation with high accuracy and simulating with high speed.

3. **Possibilities of development equipment and soft on the Trace mode for calculation and visualization process**

So it is needs to create integrated software platform for the domestic industry. An example of an integrated software programmer is the Trace mode (TM6), developed by the company Adastra Ltd, Moscow (www.adasrta.ru) for the design of instrument, process control devices and management of technology. Currently Trace mode6 has wide application in different branches of industry and it has an integrated development. Thus for any automation of production processes of enterprise it’s needs only one tool - Trace mode6. Every project of all levels are created in a single tool system and within a single project (figure 6). The technology design of automated control system eliminates unnecessary
duplication of databases, PLC, OPC server, operator workplace, equipment, personnel, production information, etc. Trace mode can use five program languages during the process of design of device. Most, but not all, features of TM are based on automatic design. The type of automatic design used is based upon automatization. Integrated software Trace mode6 has a capacity of operating resources and computer-aided design of measurement system on several levels: the mnemogramma, blocks of FBD, structured text, diagrams, etc.

Let us consider an example of the design of the instrument unit. The measured values are set using the input and output arguments. Each signal is assigned a type value, bits, and so on, thus laying the basic metrological parameter. Math functions (figure 6) are then given the signal by using a mathematical programming language of FBD-blocks [1].

![Figure 6. Principle of mathematical design with the FBD-charts.](image)

Thus, the data signal is processed and transmitted in the form of mathematical models; transmitted FBD-method blocks as method of the auto build. Integrated software Trace mode is available for practical and laboratory works, which takes place in basic and special engineering industry education. Built-in economic module creates the conditions for the creation of the project, taking into accounts the economic calculations and predictions. The projects were created on the base of program Trace mode consist the part concerned to material resources: repairs, downtime and current characteristics of equipment and production resources [6-7]. Its possible to design of mobile control system using in Trace Mode6. The laboratory works in the mode of on-line programming based on phones Nokia, Sony Erikson and etr. Thus it’s possible to program and transmit data signals through the tools of the communication [2].

So this practical work has introduced in the different disciplines like the course of lectures and practice works, which was read for students of engineering profession. Five modern program languages are use the international standards: SFC (Sequential Function Chart), LD (Ladder Diagram), FBD (Function Block Diagram), ST (Structured Text) and IL (Instruction List), which allows to create working projects by engineers who are not professional programmers, through the window «Navigator» which allows students to choose the type of create project. During the build process of the control devices applies the next procedure: the operator or the student will create a group of resources/detector, and then select the signal generator: saw sine wave, random, etc. Download trend and data processing are the next steps of the illustrating the process of the device creation on the base of integrated program Trace mode [2]. When the students are carrying out the practical exercises concerned to develop the «virtual” device, they put the signal and add the generated noise, which both then appears on the display.

4. Discussion
The conceptual scope of CAD is not well-established: there are different definitions of the conceptual area of CAD: on the basis of the so-called process approach underlying the ISO 9001 standards; from a different position than the ISO 9001. The following groups of standards should be considered in the "process approach" international standards: ISO/IEC/IEEE 24765:2010 regulates the terms in the field of information technology presented in the ISO, IEC and IEEE standards in ISO 13567:1998 and ISO 10303 are the terms presented in the ISO, IEC and IEEE standards. In turn, for the following
international standards, the "process approach" is not the main one: ITIL, CMM/CMMI and COBIT, aimed primarily at ensuring the maturity of processes; OMG and ASME focused on interoperability (interoperability) with drawing tools. Thus, concepts related to the CAD area should be analyzed in these international standards.

Analysis of concepts, as well as their definitions pertaining to the field of automated design, allows you to make the following: Concepts "automation" and "automate" define "automatic" process, that functions without human involvement, as opposed to an automated software process "that is done in full or in part with CASE tools." The conceptual area related to automated design systems (CAD) is considered in various international standards focused on the "process approach": first of all, ISO/IEC/IEEE 24765:2010 and ISO 13567:1998. It compares concepts with other process maturity-oriented standards (ITIL, CMM/CMMI and COBIT standards) and interoperability with drawing tools (OMG and ASME standards). The proposed universal data-sharing mechanism is based on the current widely used technology based on international standards: security (WSSecurity), Messaging (MOM technology), Web services and transforming data (XML, XSLT, XPath, ), business process modeling (BPEL4WS and WSCoreography), technology descriptions (WSDL technology). The concept of CAD corresponds to the definition of "CAD" which refers to the display of data, their statistical processing and simulation of the relevant processes. Further, when we mention the concept of CAD in this context (which reflects the general view of international organizations ISO, IEC and IEEE), we will record CAD as an automated product design and development “tool” as a matter of fact, the term defines the concept of "design and development" in the context of computer use, giving the term "CAD" a broad meaning.

It is clear from the above that the terms are not sufficient to clearly identify the area of the Automated Design System (CAD) and the processes, works and tasks associated with it: in particular, the terms "virtual" and "parametric estimating" is defined in such a way that the context of issues related to design automation remains behind the brackets. Another ISO standard, in which the term CAD is understood in a narrower context, is the well-known ISO 13567-1:1998 standard in international practice. In ISO 13567-1:1998, the term "CAD" is disclosed in the context of the conceptual realm of "draughting" rather than "design"; accordingly, CAD in such cases is deciphered as "Computer Aided Draughting (Drafting)," that is, "automated drawing system." Further, when we mention the concept of CAD in this context, we will say "CAD as a tool of automated drawing of objects." The ISO 10303 series standards (also called STEP and CALS-focused technology) are mostly considered the rules and features of pairing CAD models with production processes. At the same time, in THE STANDARDS of STEP, as well as in ISO 13567-1:1998, the concept of CAD is considered as a tool of automated drawing of objects. Another set of IT regulations is the standards for which the concept of the "process approach" is also not the main one: IN ASME standards (in particular), terms in design automation are considered in the context of drawing tools. OMG standards state that "mechanical CAD systems provide interoperability" of the following components of the system: CAD drawings (CAD), Software-based production (Computer-Aided Manufacturing, CAM), Computer-Aided Engineering Tools (CAE tools). On the other hand, the generalization of the conceptual area of CAD in the presented standards provides a specification for the tool being developed, considering: CAD as a tool for automated product design and development (ISO/IEC/IEEE 24765:2010), CAD as an automated drawing tool (ISO standards 13567-1:1998 and STEP), CAD/CAM/CAE component interaction system (OMG standard). It should be noted that a similar study on the terminology presented in domestic and foreign national standards should be conducted in order to be more complete and consistent in identifying the conceptual area of CAD [8-11].

5. Conclusions
The convergence of different-level standards for CAD tools will make better using of software tools and reduce errors and inaccuracies in the design of complex measuring devices. It should be noted that a similar study on the terminology presented in domestic and foreign national standards should be
conducted in order to be more complete and consistent in identifying the conceptual area of CAD
Linking together various computer programs we can create fully measuring system in virtual space
with control feedback system.

The implementation of such technologies for the teaching students will allow not only training in
computer sciences and remote control, but also will decrease the cost research using the Internet
foundation and remote control from.

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