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Computer Using Dynamic System Modelling Environments

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Abstract
The article is devoted to the development and use of computer modelling systems for dynamic systems and their capabilities. It is noted that modern modelling programs are being used to study many technical and practical processes.

Keywords: Mat LAB, Simulink, method, model, graphic, COMSOL MULTIPHYSICS, LAMMPS.

Today, Eureka, Gauss, Mat LAB, MathCAD, Mathematical, Maple, and other software systems and software packages offer automation for tasks such as modern computer mathematics, visual modeling, calculation, and design. Among them, Mat LAB is distinguished by its capabilities and high efficiency. Using Mat LAB allows you to implement a visual model closer to the physical processes that take place in the network, that is, to build a real-time visual model of complex dynamic processes. This is done using the Mat LAB system's Simulink and Power System extension packages. The libraries of these packages contain many virtual elements and measuring instruments, making it possible to study any complex system from all angles.

Modern Mat LAB has gone beyond the boundaries of a specialized matrix system and into a modeling system on a universal integrated computer. In general, Mat LAB has become a unique system that combines all the experience gained during the development of mathematical science and combines it with graphic visualization and animation tools. The programming language of the Mat LAB system has advantages over traditional programming languages, its capabilities are very wide and it can be used in all fields of science and technology to perform calculations and model processes.

The development of computer modeling methods and tools has always consisted of simplifying communication between human and computer systems and bringing the issue of programming languages closer to the issue of engineering.

A specialist who uses a visual approach to programming in the Mat LAB system, in modern software complexes of modeling, a virtual model of the problem to be solved is formed on the display screen. The built-in model is created in the form of an interconnected block diagram based on virtual elements available in the software system library or created by the user. Virtual elements are written in a high-level programming language using automated programming methods and are an important part of programming that performs appropriate mathematical operations.

The process of creating a block diagram of a problem to be solved on a display screen is fully compatible with a problem-solving program, which can consist of hundreds or even thousands of commands, depending on the complexity of the problem. This frees the user from the need to create, compile and configure complex programs.

Graphical visual programming tools automatically translate the problem into a computer language in a user-friendly, user-friendly graphical format. Allows modeling results to be presented

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graphically, for example, in the form of time or spatial diagrams and animated images. Using such tools, the complexity of creating models and the time spent on computational experiments is reduced by a factor of ten compared to the traditional method, which is to manually create an individual program for each new development.

The relative cheapness of graphical environments of visual modeling and its ease of use allow for extensive use of computer modeling for every engineer, technologist, and manager.

Currently, there are several dozen graphical environments of visual modeling, among which the following can be distinguished:

- ✓ Simulink application based on Mat LAB software system complex from Math Works Inc.;
- ✓ Lab VIEW complex of National Instruments. This environment is used to manage data collection and processing systems, as well as technical facilities and technological processes;
- ✓ Electronics Workbench (Multiuse) software package from Interactive Image Technologies Ltd. This environment is used to solve the problems of automation of modeling and design of electronic chips;
- ➢ Fem LAB (COMSOL MULTIPHYSICS) software package. This environment is used for a distributed parametric modeling system, which is described by the integral-differential equations with specific product, using the finite element method. It has the ability to simulate various physical processes. The program covers a wide range of engineering tools, including models and network development tools, descriptions of physical processes, modeling, and process studies. It can work in the Mat LAB complex or autonomously.

The application of structural and modular principles of programming allows to present different algorithms in the form of a set of unified program modules. This ultimately improves the appearance of the program, simplifies setup, and reduces the total amount of software that can be created. You can also expand the content of the Simulink library at the expense of user blocks created by the user.

Mat LAB contains a number of applications based on graphical (visual) programming methods and allowing working with Simulink:

- ✓ Aerospace Block set- includes special equipment for modeling space, jet and turbojet systems;
- ✓ DSP Block set- designed for modeling digital signal processing (DSP) issues and designing systems. These libraries include classical, multipoint, and adaptive filtering, modification, matrix operations, and important operations such as linear algebra, statistics, and spectral analysis;
- ✓ Non-Line Control Design Block set- provides the user with a graphical interface for adjusting the parameters of dynamic objects;
- ✓ Sim Power Systems- designed for modeling of electrical and power equipment and systems;
- ✓ Sim Mechanics - allows you to model control systems using non-directional signal graphs, combining them with physical models and models from other libraries.

In analog computational techniques, there are several ways to model objects represented by algebraic equations. One of the most common of these methods is the system of linear equations, which is reduced to the solution of simple differential equations, and the resulting solutions give the solution of a system of algebraic equations.

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LAMMPS Molecular Dynamics Simulator. LAMMPS has the potential for solid state materials and soft materials or macroscopic systems. It can be used to model atoms or, in general, as a parallel particle simulator on an atomic or continuum scale. LAMMPS operates on a single processor or in parallel using spatial fragmentation of the transmission technique and simulation domain. Many of its models have processors, GPUs, and versions that provide accelerated performance on the Intel Xeon Phis. Designed to make it easy to change code or expand with new features. Therefore, it is recommended to use the program on computers with high-end processors. LAMMPS GPL is conditionally distributed as open source code.

The COMSOL MULTIPHYSICS program was useful when we were working on the problem of determining the convective heat transfer coefficient in some parts of absorbers in one of the main problems of heat transfer in complex designs of solar air-heat collectors in our research. Theoretical calculations have been studied to determine the color temperature of the surfaces used to determine the temperature of the solar air heating collector (SAH) absorber from metal shavings. The results of experimental studies were obtained to determine the description, methodology, and temperature of metal shavings of SAH construction as a function of their surface color. The goal now is to study the molecular dynamics of the process in the LAMMPS program.

Mat LAB / Simulink environment allows computer modeling of processes and systems, application of structural and modular principles of programming, presentation of various algorithms in the form of a set of unified program modules. The application of these technologies in the field of education will ultimately serve to improve the quality of education and train highly qualified personnel.

LAMMPS developers offer a software package that is versatile, reliable, efficient, and easy to maintain and modify. All of these goals are very difficult to achieve because a large portion of LAMMPS consists of code added by many different authors, and many of them are not professional-level programmers and work with the unique features of storing a large software package. In addition, changes that interfere with the parallel efficiency of the core code should be avoided. LAMMPS will continue to grow and functionality will be added and at the same time it will become a necessity to work to improve the existing code.

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