

THE USE OF INNOVATIVE TECHNOLOGIES ON THE BASIS OF THE MATLAB ENVIRONMENT WHEN CONDUCTING LABORATORY CLASSES ON TECHNICAL SUBJECTS

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Abstract: discusses the use of simulation laboratory facilities for the study of the modes of operation of technical devices in MatLab. The questions using the Simulink program in MatLab for carrying out virtual studies. It is shown that this approach to teaching allows students to gain the skills of research and analysis of various technical devices.

In the process of training of highly qualified aviation professionals is an important aspect of their training with the use of modern information technologies. One such technology is the use of Matlab in the classroom, which is used for solving technical computing [1,2,3].

At the chair of technical disciplines of this package is used to develop new laboratory facilities, course and degree designing, and also during the practice and research [1,2]. To improve the efficiency of laboratory practice used by one application environment Matlab – Simulink.

In the simulation using Simulink is the principle of visual programming, whereby the user on a screen of a library of building blocks creates the model and carries out the calculations. Thus, in contrast to the classical modeling methods, the user does not need to thoroughly learn a programming language and numerical methods of mathematics, and enough General knowledge required when working on the computer and, of course, knowledge of the subject area in which he works [1,2].

In the study of disciplines «Electrical machine» and «Automation and control» using simulation in MatLab created virtual models of automatic control systems (ACS), electrical machines that allow you to withdraw during the study data, build different characteristics, to study the operation of electric machines, operation of ACS when changing modes, etc.

Using the Simulink program in MatLab consider the example of the aviation system voltage regulation, which consists of contactless AC generator type GT and voltage regulator. In Simulink&MatLab they are set in their own block Transfer Fcn. Links, characterizing action of external disturbances are set blocks of type ' Gain [2].

To evaluate the effectiveness of the voltage regulator developed its mathematical model [1,2] and in the MatLab environment developed a virtual model of the voltage regulator BRN120T5A (figure 1). The input to the model v_{ref} is supplied the required voltage (setting of voltage regulator); the input is fed the output V a parameter vector, containing longitudinal and transverse components of the generator voltage in axes d , q [2]. At the output of the Proportional Saturation farmarkesa the excitation voltage generator, which is then fed to the controller output V_f [3].

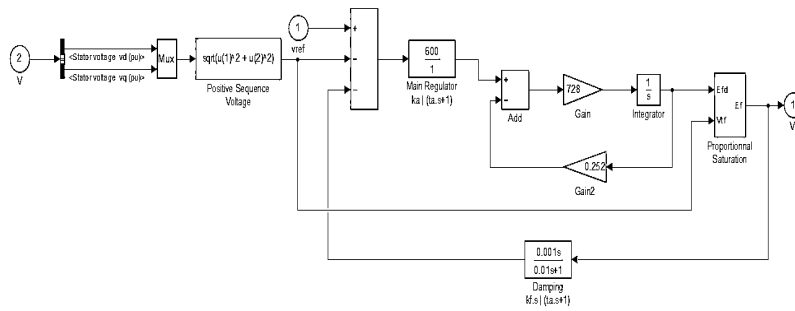


Figure 1 – Model of voltage regulator in BRN120T5A in Simulink & MatLab

To optimize the controller parameters and the research of its effectiveness was collected, a model system for voltage regulation in Simulink & Matlab (figure 2); the generated requirements to a desired transition in the system; the values of the optimal coefficients of the PID controller; the received transfer function and the estimated quality of the transition process [1,2].

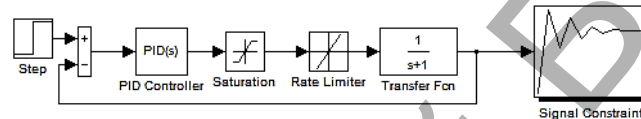


Figure 2 – Is the Simulink window of the collected schemes

This scheme (figure 2) includes: PID Controller block to set the coefficients of P-, PI-, PD- and PID controllers (Simulink Extras/Additional Linear/PID Controller); Saturation block that limits the level of the input signal (Simulink/Commonly Used Block/Saturation); Rate Limiter block, the limiting value of the derivative of the input signal (Simulink/Discontinuities/Rate Limiter); Transfer Fcn block to specify transfer functions (Simulink/Continuous/Transfer Fcn); Step – unit for defining the input step signal (Simulink/Sources/Step); Sum – the adder (Simulink/Commonly Used Block/Sum); Signal Constraint block to optimize the parameter of the controller and set your desired transition process (Simulink Response Optimization/Signal Constraint).

Optimizing the parameters P-, PI-, PD- and PID controllers was performed using package Signal Constraint. We started the transition process to the Simulink Response Optimization was specified, what measures should I modify and customize [1,2].

After optimization, the MatLab program displays a message that resembles the following (figure 3), which shows the coefficients of the transfer controllers , for optimal that satisfies the conditions of the transition process.

Iter	S-count	f(x)	max constraint	Directional Step-size	First-order derivative	optimality	Procedure
0	1	0	331.8				
1	6	0	41.3	0.0478	0	1	infeasible
2	9	0	0.2882	0.0725	0	1	Hessian modified
3	12	0	0.02226	0.0587	0	969	Hessian
4	15	0	0.0001852	0.00536	0	15.8	

Successful termination.
Found a feasible or optimal solution within the specified tolerances.

Ki =
0.1844

Figure 3 – Simulation Results of the optimal coefficients of the controller

After this research is conducted on the developed virtual model of the system regulating the voltage regulator BRN120T5A (figure 4). Figure 4 generator GT30NZCH12 and voltage regulator BRN120T5A are represented by Subsystem blocks from the library Simulink/Commonly Used Block Simulink of the MatLab environment, from the same library unit presents the Sum adder, and the Step blocks from the Simulink library/Sources.

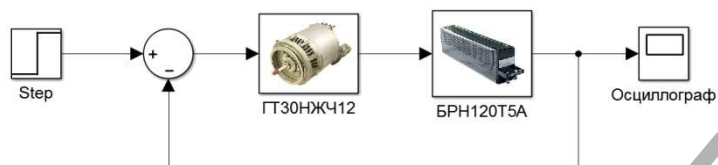


Figure 4 – Virtual system with generator GT30NZCH12 and regulator BRN120T5A

In data blocks placed model generator type GT and model of voltage regulator BRN120T5A. The oscilloscope is represented by the block Scope from the library Simulink/Sinks [1,2]. Virtual modeling in MatLab of the system regulating the voltage generator type GT and a voltage regulator BRN120T5A under various perturbations allowed us to determine the effectiveness of this system of regulation – the limits of permissible values of the speed characteristics of regulatory systems [1,2].

Thus, the use of simulation laboratory installations allows you to securely consolidate the theoretical material in practice and to provide in-depth study of students of technical disciplines to gain the skills of research and analysis of various technical devices and systems.

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