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THE USE OF THE ROBUST CONTROL METHOD FOR REGULATION IN SYNCHRONOUS GENERATOR SYSTEMS

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ABSTRACT

The article analyzes the problems of strict control of excitation of synchronous generators, quality indicators of automatic control systems, factors affecting control and their origin, methods of control of synchronous generators, trends, theories, the basic structure of a robust control system.

OBJECTIVE

Interpreting a robotic control system by comparing methods for controlling synchronous generators in a power system. Improvement of the generator control system using a robotic control system.

METHODS

In the experimental program matlab, a chart type diagram was compared. Investigated by the traditional method of using the method of robust control for the regulation of the synxron generator in the system.

RESULTS

From the results obtained on the diagram typed in the Matlab program, it can be seen that the control system of a synchronous generator with a control system for the excitation coil is more reliable. Such a control system allows the synchronous generator to increase the stability margin and control the parameters with a minimum error.

CONCLUSION

Reliable control of synchronous generators is essential in the power grid. By improving management, this improves the quality parameters of the network and, in turn, extends the working hours of consumers. It is recommended to use this method in management.

Keywords: control, excitation, synchronous generator, quality, mathematical model, reliability, stability, distribution, minimization, fluctuations, mode.

INTRODUCTION

Problems of strict control of excitation of synchronous generators. The quality of automatic control systems is determined by a number of indicators, which must retain their values when the final parameters change under the influence of various factors. Management of real objects is complicated by various uncertainties, such as changing the dynamic properties of an object, incorrect assignment of faults, unaccounted for delays, etc. As a result, there is a discrepancy between the mathematical model and the real object. However, the mere presence of reverse sequences in technical solutions is not enough to guarantee the reliability or robustness of the model against uncertainties. If at any point of adjustment, the setpoint parameters are located around this point, then we can say that the system parameters and the system itself are robust [5]. The purpose of the study of an automatically controlled parametric system with variable parameters is to evaluate and measure performance. It is divided into two main directions for analyzing the robust stability of an automatic control system. The first trend is based on various matrix inequalities and Lyapuno's theory [10]. For the second trend, interval method analysis is used. Assessment of the degree of robustness of automatic control systems is currently an open question. Nevertheless, a robust optimal control system is widely covered in the literature, and methods for constructing linear controls in essence of a Gaussian distribution in cases of external interference of linear sequences are aimed at minimizing integral-quadratic criteria. Of particular interest is the approach based on the basic solution of minimization problems and the creation of appropriate reliable controls, despiteon some disadvantages, such a control system provides stable stability [9] [4]. Formulation and discussion of the control issue: The excitation system of synchronous generators is of great importance in the process of large-scale energy exchange between stations. The system is the main means of maintaining stability during low-frequency dynamic and electromechanical vibrations in various operating modes.

METHODS

Existing conventional controllers, automatic drive controllers (with a strong impact) ARV (in the CIS) and PSS system power stabilizers (abroad) have limited control capabilities due to constant adjustment of parameters. As a result of the influence of uncertainties associated with different operating conditions, the problem arises of constructing an exemplary system of regulators that ensures optimal independence of the system from such a regulator. The theory of H∞-control is used in the development of the robust mechanism of the excitation field [6].

A feature of the method is that it allows you to directly introduce uncertainties in the synthesis of a controller, taking into account the boundaries of the controlled object model. The control device generated by the H∞-control theory has a dynamic communication structure with a constant parameter, and for its implementation it is sufficient to enumerate the parameters of the control signals. There are two different approaches to building a robust excitation circuit for synchronous generators: centralized and decentralized. The first approach is based on the creation of a single multi-position control [1] [2].

Based on the second approach, a set of single inputs is created (in accordance with the number of controlled output variables) - a single output control element that forms the same number of additional control loops. The second approach is poorly understood. For practical purposes, the control of synchronous generators (SG) can be limited to the task of improving the vibration of the SG in various operating modes. The study uses the Park-Gorev equations to create a mathematical model of a synchronous generator. The external inductive reactance of the power system is written in relative units (Fig. 1.) [7].

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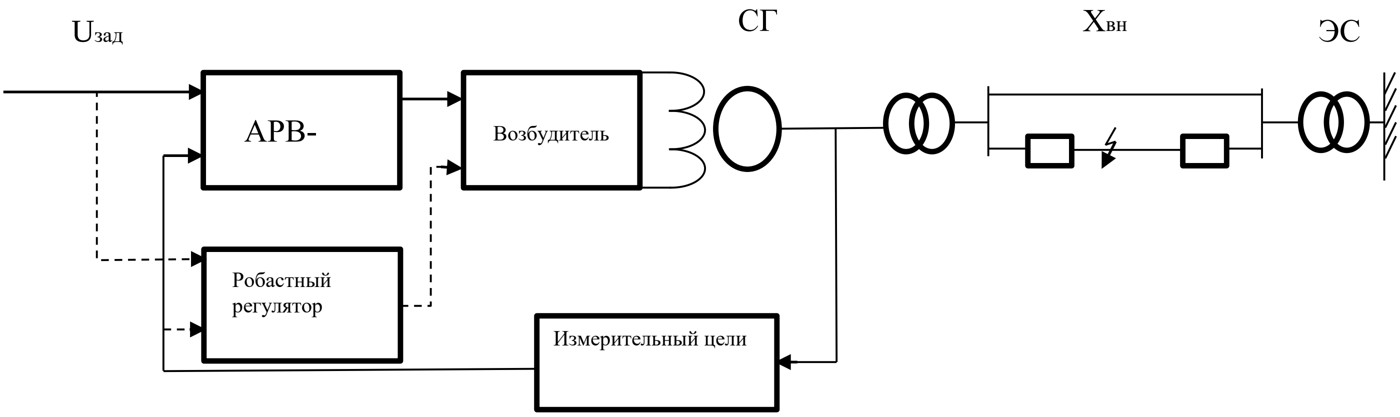

Fig. 1 - Functional diagram of the excitation control system synchronous generator.

Functional diagram 1 shows the connection of additional robust control. Traditional (ARB) excitation control is based on two communication channels. The first is the synchronous generator control channel, the second is the dynamic process damping channel, which adapts the generator to the power system. In conventional stabilization, feedback is used on the frequencies of the voltage deviation () and the excitation current ().

Overseas use (PSS) power deviation () and frequency feedback (Δf). The ΔU voltage deviation monitoring and its product () is the same as the voltage variation monitoring and is also called the partial discharge law. In some cases, it is also called the legal PID for an individual station. It is necessary to build a tight control based on the existing output parameters, providing a satisfactory damping of dynamic processes in all small sections of the regime.

Strong robust control should be small and easy to implement. With automatic control, the voltage is kept constant to effectively damp the frequency and power angle parameters. The solution to the problem, taking into account its specificity (achieving effective damping), it is advisable to reduce to the synthesis of one-dimensional (single-input - single-output) robust controllers. The controlled object should be considered as a set of interconnected subsystems equal to the number of linearly independent outputs. Thus, SG + ARV + SS is a set of interconnected one-dimensional subsystems. [8]

The main structure of a robust control system for synchronous generators:

Figure 2 shows the basic robust control structure of a synchronous generator.

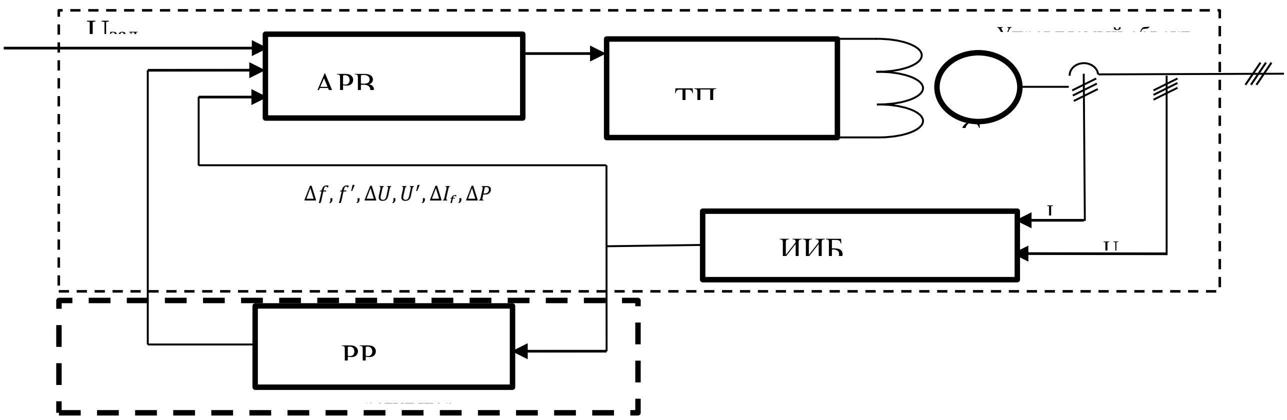

Figure: 2 - Structure of a synchronous generator with a robust controller.

DISCUSSION

In terms of research objectives, we describe the blocks and relationships of the structure as follows. The traditional SG + ARV system is used as a control object. The system consists of an automatic drive control system with a stabilizer (usually a strong ARV), a thyristor converter (TP), a data transmission unit, and blocks that turn off the required variable. In the regime of large disturbances (one-three-phase short circuit), the dynamics of the corresponding structures is estimated. Today SG + ARV is a system that embraces the external people's system.

For additional stabilization, the robust control system is connected as an outer ring. The purpose of the outer ring is to expand the boundaries of static and dynamic stability. More precisely, we can say, to increase the degree (or quality) of damping of electromagnetic oscillations and the maintenance of this state in various modes [5] [3].

Measurement units process all control parameters through filters. The number of blocks can be up to 20 pieces. The analysis mainly considers the following tasks:

- Modern devices allow measurements to be taken at very short intervals.
- In most cases, measurements are made using digital elements, in which case a very small average is observed, but no inertia is observed. The result is a robust control system through the data measurement units at a minimum level. To further reduce the stage of operation of the ARV-SG system, in the reduction mode, the ARV-SG system or a synthesized robust control device can be used.

CONCLUSION

In conclusion, we can say that all control systems of the excitation coil of a synchronous generator must perform three functions: the block diagram of the system-drive field, the distribution of reactive power of technologically parallel generators, charging with a drop in frequency and similar issues, protection - limitation of reactive power in accordance with a given stagnation , stator overload protection functions. Under the conditions of the Gaussian transient process, the distribution of the integral quadratic criterion is stable.

With this control, the choice of the matrix affects the stability, despite some distortions. H∞-minimization is a problem-solving approach that minimizes and creates consistently reliable control that is of particular importance. The control system for all excitation circuits of synchronous generators must provide systematic, technological and protective functions. The robust control system is designed to perform a system function.

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