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## Extreme Control System for a Thermal Object

Education of highly qualified personnel, having modern knowledge and practical skills, is one of major tasks of educational establishments. Hence, in the process of training young specialists a lot of attention is paid to improvement of content, methods and techniques of training.

The department of automation and computer systems has introduced and implemented in educational process a laboratory stand, created on the basis of the programmable logical controller (PLC) VIPASystem 200 V. The stand consists of a thermal object, hardware and software of the automatic control system (ACS). This stand allows carrying out physical modeling of ACS illustrating different laws of control.

Most technological processes in mining industry have extreme static characteristics. The use of extreme ACS is the most effective way of controlling such processes. Therefore, implementation of such control systems would give the students an opportunity to investigate control processes that occur, and also to get practical skills of their synthesis and analysis.

The results of research experiments executed on a laboratory stand showed that a thermal object has extreme static characteristic in the control channel "frequency of fan rotation – speed of air heating in the object". This enabled the creation of extreme ACS with the air heating speed of stepping type. Such system is based on a principle that through a certain intervals of time air temperatures  $t_1$  and  $t_2$  are measured. This is fixed by two storages devices. Then in the comparing device the difference of the temperatures obtained at the beginning and at the end of every interval (step) is calculated. If during the examined period the speed of heating diminishes, then the working signal is reversed. Otherwise the signal is not reversed. The working signal is sent to the chain of contour of extreme control on the entrance of a regulator, changing positions of regulative organ of linear part of object. The set sequence of functional elements operation is carried out by the impulsive command generator, which is a combination of impulse generator and the stepping impulse distributor.

The developed extreme ACS allows for students to study the processes and determine parameters, characterizing the quality of its work:

- the time necessary for the parameter to reach its extremum;
- the frequency and amplitude of fluctuations of the parameter in the extremum area ;
- the influence of hindrances on the step  $\Delta t$  size .