

Energy saving in the power plants using automatic control

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Abstract:

The constant striving to reduce energy consumption leads toward introduction of strategies, which can enable it. In this paper, the strategy which includes frequency regulators into control system of condensate level in condenser of turbine in thermal power plant Gacko is proposed. Properly tuned PID (proportional-integral-derivative) controllers are precondition for appropriate process control. Therefore, the mathematical model of this system is formed and simulations of auto-tuning of PID controllers, using ideal relay and saturation relay as nonlinearity, are carried out. Static load disturbance are considered too, because of its adverse effect both directly on the object, and in auto-tuning process, which causes errors in determining of PID regulator's parameters. The justification of the introduction of frequency regulators has been confirmed by calculation of energy saving. Its feasibility was proved through simulation of the functioning of the entire control system of level in condenser, based on consideration of characteristic parameters of system response.

Keywords:

Auto-tuning, Energy saving, Frequency regulators, PID controller, Process control.

1. Introduction

Energy savings as a goal isn't responsibility just for final consumers, but also during its production. In thermal power plants, energy efficiency in converting heat into electricity has large importance, because the rest of energy is lost through the chimney, turbine, generator, output transformers and is spent on drive of power plants. Thermal power plant Gacko has huge losses because of low quality of coal, bad combusting in boiler and high energy consumption by its components. Namely, there are 40% uncombusted elements that can burn. Therefore, its energy efficiency isn't on high level and ranges from 30 to 34% [1]. In this paper, the possibility of energy savings that is used to power thermal plants is explored. This energy is using to drive devices, which are necessary for functioning of the entire energy production system such as electric motors to drive pumps and valves. Control system of condensate level in condenser of turbine in thermal power plant Gacko (Bosnia and Herzegovina) is considered.

So, the aim is to control energy consumption in the mentioned system. Therefore the analysis of technical feasibility and economic justification for the strategy that includes frequency regulators is carried out. These devices optimize the amount of energy used to drive electric motors in this system. To achieve an adequate process control it is necessary to properly tune the PID (proportional-integral-derivative) controllers, as essential parts of the control system. Auto-tuning of PID controllers using relay feedback test is simulated on mathematical model of the process in the Matlab software. Substantial influence of static load disturbance on the object directly, i.e. during its operating and indirectly, in the auto-tuning of PID controllers, initiated the application of methods for its compensation. This means that the goal is minimizing errors in the estimates ultimate gain and ultimate period of the process, because these parameters are directly used in auto-tuning of PID controllers.

