Comparison of Two Approaches to Identification Process of Condenser in Thermal Power Plant

Novak N. Nedić [1], Saša Lj. Prodanović [2*]
[1]Faculty of Mechanical and Civil Engineering in Kraljevo, University of Kragujevac, Kraljevo (Serbia)
[2] Faculty of Mechanical Engineering East Sarajevo, University of East Sarajevo, East Sarajevo (Bosnia and Herzegovina)

Appropriate mathematical model of process is being emphasized because it affects to possibilities of system analysis and synthesis. Transfer functions of condenser of turbine in the thermal power plant Gacko (B&H) obtained according two different identification methods have been analised and compared in this research. Identification based on input and response of real condenser (i.e. its level as function of time) had been carried out and considered, versus one performed by simulating of relay feedback test in the previous surveys. Final evaluation of the both transfer functions of condenser has been established after tuning of PI controller, which exists in the control system of level in condenser in mentioned power plant, and analysis of system responses. Namely, they were tuned using the same method, i.e. internal model principle (IMP) and their calculated parameters were introduced and simulated in the entire control system to get process responses.

Keywords: Level in condenser, Identification methods, Internal model principle, PI control.

1. INTRODUCTION

Within the all methodologies of system analysis and synthesis, which begin with mathematical model of process, tuning of the controller is one of most important parts. Researches in this paper refer to the defining this model, i.e. identification of the process, that is in some variants necessary for enabling of good controller. There are a lot of approaches in obtaining of process transfer function. Each of them has its minor or major advantages and disadvantages. The quality of process behaviour, as a main topic, depends on abilities researchers and operators to recognize, how features of methods influence (through entire procedure) on the final desired process performance. Some authors, (Åström and Hägglund) prefer relay feedback test, while the others (Ziegler and Nichols) base their identification ways on the real responses [1]. Meaningful overview of this topic can be seen in [2,3]. Surely, modelling using physical postulates shouldn't be neglected.

This survey is focused on the control system of level in condenser of turbine in thermal power plant Gacko. Previous investigations of this system [4,5] were performed in order to enable good system characteristics through the appropriate tuned controller. PI controller is chosen because this type of controllers is the most suitable to the first order processes, how this condenser should be modelled. That is an attempt to obtain PI controller parameters using scientific principles, and thus avoid current practice of tries and mistakes. The idea for this research has appeared after comparing recorded condenser response with its simulated variant obtained using relay feedback test for process identification. It was seen that mathematical model can be derived more accurately, i.e. identification method may be better. Improvement of this procedure will be carried out here. Therefore, two approaches in identification of this condenser will be compared by analyzing responses that will be obtained using simulation. First approach is based on relay feedback test [5], but the second one is combination of data collected from real process response and formulas taken from previous models of this control system that were calculated according physical postulates. Mentioned simulation is performed using block diagram of energy saving strategy that was developed for this control system in [4].

The importance of defining the most representative model of process is bigger because internal model principle (IMP) will be utilized for calculating parameters of PI controller.

2. CONTROL SYSTEM STRUCTURE

Brief explanation of system functioning will be exposed, in order to place this problem into industrial environment. This control strategy was developed and suggested in previous investigations and it is based on use of frequency regulators in order to reduce energy consumption of the entire control system [4].

Level control is performed using two closed-loops, as it shown in Fig. 1. The first one refers to the condensate drainage from the condenser and the second refers to the demineralised (DEMI) water supply.

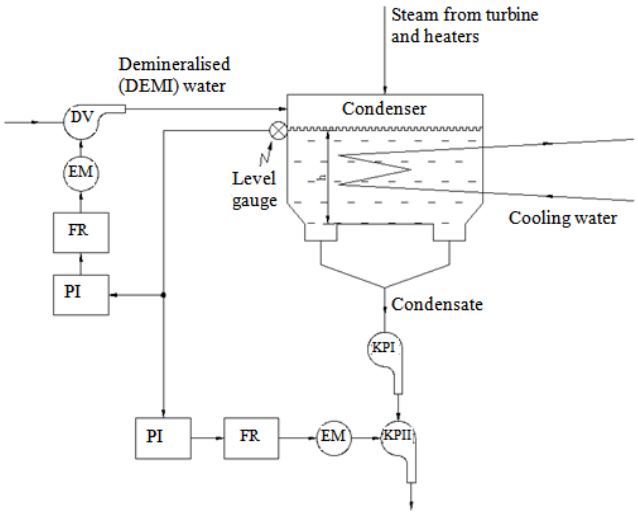

Figure 1: Structural diagram of system for level control in the condenser of turbine [4]

*Corresponding author: Vuka Karadžića 30, East Sarajevo, Bosnia and Herzegovina, sasa.prodanovic@ues.rs.ba