XI International SAUM Conference
on Systems, Automatic Control and Measurements
Niš, Serbia, November 14th-16th, 2012

Some Modifications in the Process Identification and Tuning of Controller of Level in Condenser in Thermal Power Plant

N. N. Nedić + and S. Lj. Prodanović ++

+University of Kragujevac, Faculty of Mechanical Engineering Kraljevo, Dositejeva 19, 36000 Kraljevo, Serbia
Phone: (+381 36) 383-377, Fax: (+381 36) 383-378, E-Mail: nedic.n@mfkv.kg.ac.rs ,WWW:http://www.mfkv.kg.ac.rs/

+University of East Sarajevo, Faculty of Mechanical Engineering, Vuka Karadžića 30, 71123 East Sarajevo, Bosnia and Herzegovina
Phone: (+387 57) 340-847, Fax: (+387 57) 340-847, E-Mail: elsing123@yahoo.com , WWW:http://www.maf.unssa.rs.ba/

Abstract *– Proper tuning of controller of condensate level in condenser of turbine in thermal power plant is precondition for correct system functioning. Process identification and tuning of controller, as two essential things, will be presented here. One of the goals is enhancing of the controller robustness in relation to non modeled dynamic of process. Modifications include: proces identification using saturation relay feedback test and tuning of controller based on internal model principle. This approach was illustrated using simulations. These improvements have been explored and suggested for control system of level in condenser in thermal power plant Gacko.*

Key words: *saturation relay feedback test, controller tuning, internal model principle*

I INTRODUCTION

In the presence of numerous methods for tuning parameters of controller, operator should choose optimal one in given circumstances. That method gives good system behavior, which is always a goal. Also attention must be paid to the robustness of the system. Here object of research, like in [1], is condenser of turbine in thermal power plant Gacko.

A. Short system description

In spite of earlier descriptions of mentioned system, short explanation will be presented here, due to easier understanding of following investigations.

Control system of level in condenser in thermal power plant Gacko is constituted of two closed loops. Condensate drainage from the condenser is controlled in one loop and demineralised (DEMI) water supply is controlled in the other, as shown in Fig. 1. Where are: PI – proportional – integral controller, FR – frequency regulator, EM – electric motor (asynchronous), DV – centrifugal pump for DEMI water supply, KP I – centrifugal condense pump first order, KP II – centrifugal condense pump second order. This control strategy was developed and suggested in previous surveys [1]. It`s purpose is energy saving using frequency regulators.

During system functioning, level in condenser should be held on desired value (set point) h_z = 1,2 (m). This is one of the indicators of proper operation of entire plant. Obviously from Fig. 1, PI controllers enable reference value for frequency regulators, consequently their tuning is very important.

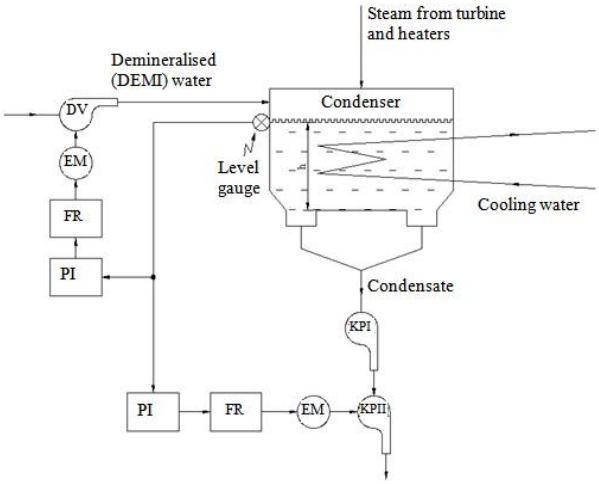

Fig. 1. Structural diagram of system for level control in the condenser of turbine [1]

B. Aims

Some of methods that can be used for tuning parameters of controller are: relay feedback test using ideal relay and saturation relay [1,2,3], λ - method [4,5], internal model control [2], etc. Choice of appropriate method depends on process parameters that operator should enable.

Along with always present requests for good dynamic and static characteristics, this survey involves an attempt to improve system robustness. In this research two modifications will be introduced. Firstly, mathematic model of process (based on physical laws) is used in simulation of process identification, i.e. to obtain first-order plus dead time model of process, because it is necessary in internal model principle for tuning of PI controller [2,4]. Utilization of that tuning method is second modification and it enables significant possibilities for adjusting of system robustness. PI controller is tuned here, because it is the best for first-order processes.

Therefore, the main goal is to avoid introducing real relay feedback test in front of the object in exploitation, but simulate that process in software Matlab in order to obtain first-order plus dead time model of process. Because of that