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FLC CONTROL FOR A WATER LEVEL CONTROL SYSTEM IN A THERMAL POWER PLANT

Tran Thi Van Anh

Faculty of Mechanical, Electrical and Electronic Technology,Thai Nguyen University of Technology, Vietnam

Abstract

The control structure of the steam boiler system is one of the most complex systems required with many control loops and multiple parameters. It is necessary for the controller used for this system to ensure the efficiency of the steam. In industrial production systems, different technological processes require the appearance of steam to generate torque as turbines for thermal power plants. The steam boilers of the thermal power plant are demanded to maintain a continuous water level for producing high-temperature steam and at high pressure. The paper introduces the level control algorithm for the steam boilers of the thermal power plant and the applied Fuzzy Logic Controller controllers.

Keyword: The thermal power plant, the steam boiler, cascade control, FLC controller

1.INTRODUCTION

The study concentrates on a control problem in the combustion chamber and the steam boiler. The combustion chamber is a multiple outputs and inputs system, in which fuel, wind and water supply are its inputs, and the output consists of saturate steam released from the steam tank, an amount of redundant water, smoke and slag from the combustion process. In this case, water is heated in a boiler until it becomes high-temperature steam [1-4]. This steam is then channeled through a turbine, which has many fan-blades attached to a shaft. As the steam moves over the blades, it causes the shaft to spin. This spinning shaft is connected to the rotor of a generator, and the generator produces electricity [5-11]. The steam boiler collects steam then delivers it to the turbine.

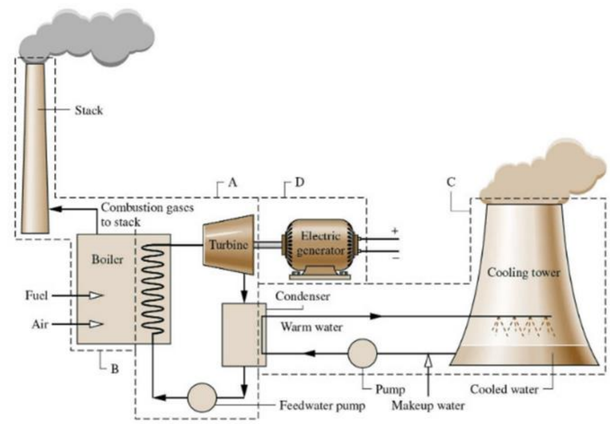

Figure 1 Steam turbine power plant [12]

2. DESIGN THE FLC CONTROLLER

The Fuzzy Logic Controller (FLC controller) used in this research consists of two inputs and a output defined as Fig. 2. The input variables are the control signals of the fuzzy controller, which is the control voltage error (ET) and the derivative of the error (DET); and output variable is the control voltage U.
Firstly, the number of fuzzy sets for each language variable is selected as 7 sets with the 7 language variables in each term named as follows: AL, AV, AN, K, DN, DV and DL attached to membership functions as Fig. 3. As we know, the number of fuzzy rules tends to infinity; in this case, we make control rules written.

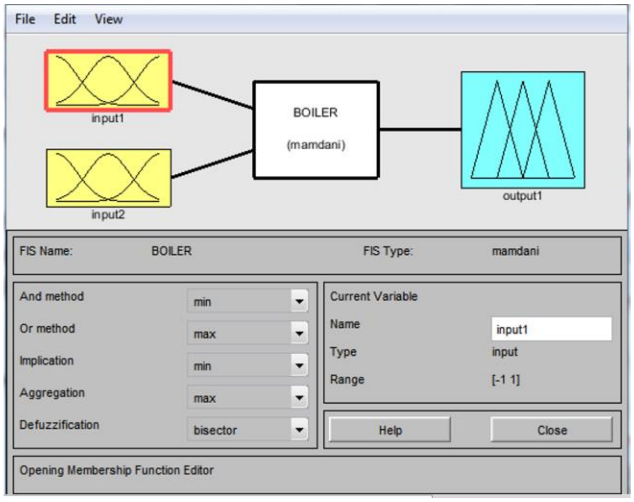

Figure 2 The input and output variables

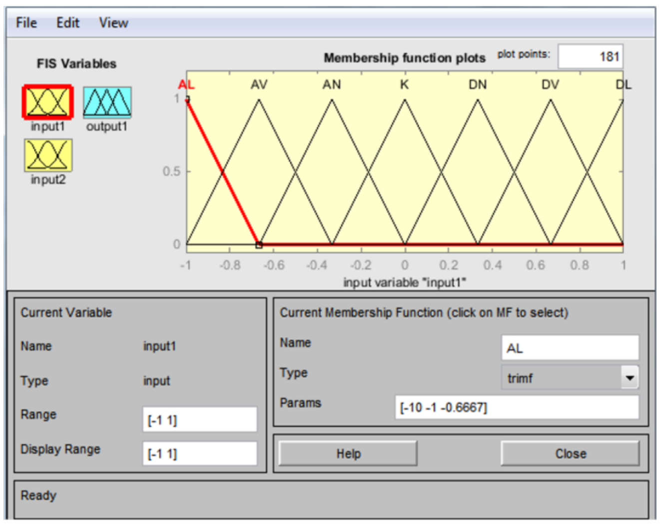

Figure 3 The fuzzy sets of language variables

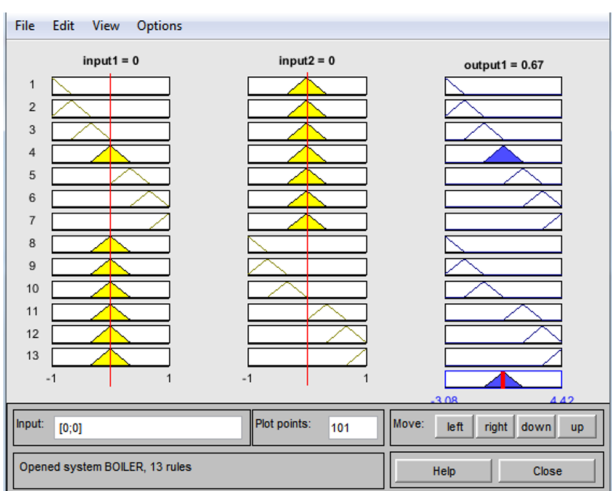

Figure 4 The input-output relationship

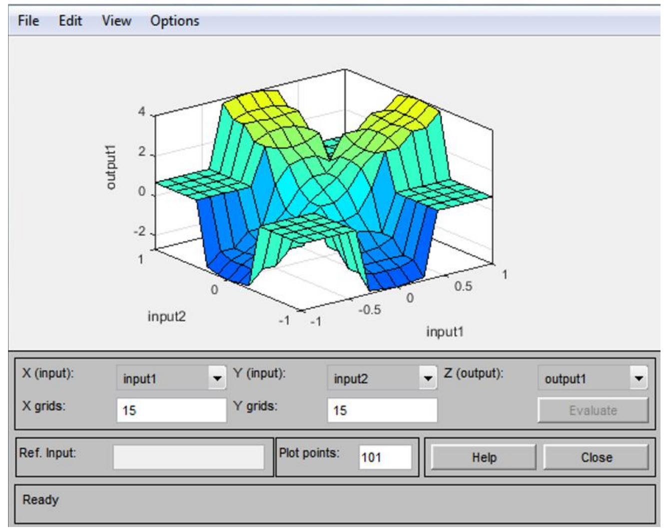

Figure 5 The equivalent input-output

With the mathematical model of the system in [12,13], response results of the control system using HA are shown in Fig. 6.

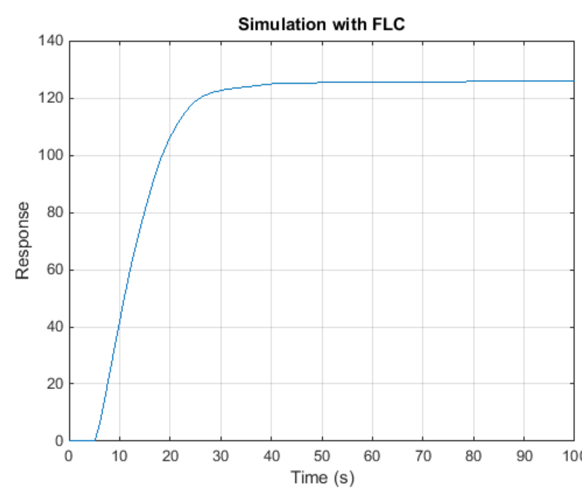

Figure 6 The response of system

The system response shows that the FLC controller designed for the steam boiler offers a high performance with low overshoot and short settling time.

3. CONCLUSIONS

The level control algorithm for the steam boiler in the thermal power plant has been developed and designed by the FLC controller. The design sequence is done through the simulation steps on MATLAB/Simulink to verify the theory and demonstrate the effectiveness of the control algorithm. The simulation results show that FLC controllers meet well the control requirements.

4. ACKNOWLEDGEMENT

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