Level and Temperature Control

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There are some variables that are usually controlled in process industry. Two of them are level and temperature. Some variables are easy to model and control because they are linear and simple. But it is quite different in some of them because of non-linearity, complex model and also uncertainty. Level is linear but temperature is non-linear. The interaction of both variables is difficult to model mathematically. Many control approach theory can be applied to solve this problem. It depends on the type of components that is available in the work station. It is interesting to play with a real plant because we don't just play with the equations and model, but we have to apply it to the real plant process.In the Festo Process Control Work Station [1], there are some components and control moduls. But it is only for the components and moduls those are related to temperature and level control. As the software, LabView is already connected to the NI modul as the interface [2]. So it can be programmed directly to computer.

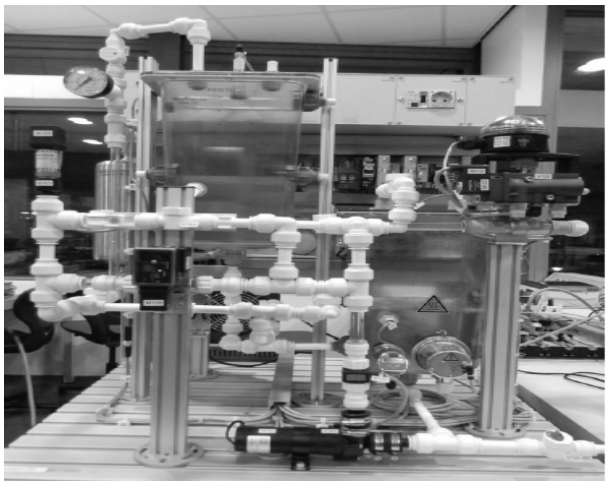

Figure 1: Festo Work Station

The main goal of this research is to control the level and temperature in the work station such that:

1. The level in the lower tank follows the set point as fast as possible, with a very small overshoot.
2. The temperature in the lower tank follows the set point as fast as possible with a very small overshoot.

Control Approach:

In this system, MIMO Control can't be made by PID controller because the control modul doesn't support the configuration flow system [3]. And also one of the actuator is a relay (the heater), so its outputs are on / of only. Then the value can be manipulated like the pump or the propotional valve. So, the only possible way is using on-off control for the temperature controller . Using on-off Controller because the temperature actuator is digital output (binary) [4]. Because this is a MIMO control, there is a interaction between level control loop and temperature control loop. The level control will affect the temperature control. But the temperature control will not affect the level control. So I use on-off

control for the temperature for removing the affect of level control. But in level control I use PID control.

Controller Design :

For modelling we will use steady state test and response step test. After modelling we will get the value and the transfer function of the open loop system [3]. And then we will design the PID controller for the level. For tuning the PID value we will use Ziegler- Nichols method [4]. As the temperature controller, on- off control is a binary state programming that can be designed in LabView directly. Both the temperature and level controller with all their components and values will be designed in the LabView software.

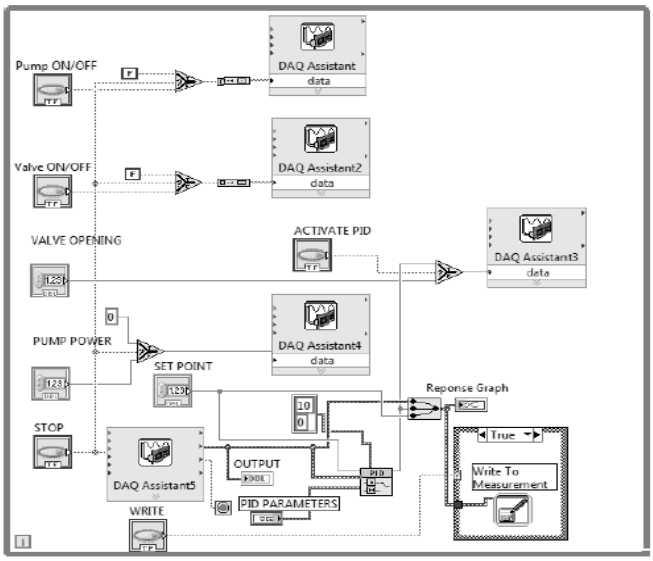

Figure 2: Example of LabView Design

REFERENCES

[1] Festo, Manual Guide
[2] National Instrument (NI), LabView Manual Guide
[3] Norman S. Nise, "Control System Engineering", Jhon Wiley & Sons Ltd, 2011
[4] William Y. Svrcek, Donald P. Mahoney, Brent R. Young, "A Real – Time Approach To Process Control", Jhon Wiley & Sons Ltd, 2006