Analysis Of Liquid Level Control Of Coupled Tank System By Pi, Pd, Pid Controller

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Abstract: This paper presents the approach to design the comparative study or tuning of PI, PD & PID Controllers for Interactive Coupled Tank System to Control Water Level. In this paper MATLAB is used for modeling and testing of the control system. The experimental results of the interacting water level process can be satisfactorily illustrated the transient response and the steady state response.


1 INTRODUCTION
To model the industrial process is necessary to design the linear controller such as PI, PD & PID. Liquid level control is a typical representation of process control and is widely used in iron and steel, chemical, petroleum and other industries. The control quality directly affects the quality of products and safety of equipment [1]. However, the liquid level control system of water tank is a large lag, time-varying and nonlinear complex system and is very difficult to control. Now, the liquid level control has been an active area in the process control over last decades and various different approaches have been devised. In this exercise, the system is model, calibrate, and control a single & twin or two tank level control system. In particular, this exposes the fundamental modelling principle of fluid mass balance, pressure sensor calibration, and a feedback control design methodology for a state-coupled, twin or two tank level control system.

2 METHODOLOGY
Interacting Coupled Tank System Process:
According to Figure 1, The nonlinear equation can be obtained by mass equivalent equation and Bernoulli’s law is given by:

The flow out of the second tank is determined by the liquid head in that tank, i.e.

However, because of the coupling between the two tanks, the flow out of the first tank is determined by the difference in levels of the two tanks, i.e.

Thus the final set of ODE’s that describe system behaviour is given by:

After Linearized the above non-linear equations and taking Laplace Transform, we get

After taking values, the Transfer Function obtained is:

TF = \frac{0.036}{36.942s^2 + 12.1568s + 0.451}
3 Simulation & Results

![PID Controller Simulink Diagram]

**Figure 2: PID Controller Simulink Diagram**

![PID Constants Diagram]

**Figure 3: PID Constants**

![Response for PI Controller Diagram]

**Figure 4: Response for PI Controller**

![Response for PD Controller Diagram]

**Figure 5: Response for PD Controller**

![Response for PID Controller Diagram]

**Figure 6: Response for PID Controller**

4 CONCLUSION
As a conclusion, PID Controller had been successfully designed to controlled liquid level at tank2 on coupled tank system using simulation or matlab. The matlab simulation analyse the PD and PI, where PD shows higher accuracy and much less speed of response than PI type of controller and we generally used error and trial method. PI Controller gives more oscillatory System which, gives higher speed response result, higher overshoots implies the system run towards the instability than PD Controller which gives much less oscillations or negligible oscillations, thus system goes towards stability or system becomes stable. The PID Controller shows the optimal solution than PI or PD Controller. It removes all limitations of PI & PD Controllers. Thus it is called implemented form of PI & PD Controller. It gives increase speed of response, accuracy, control oscillations and minimize the steady state error of system, and system become stable or increase the system stability. A model for a coupled tank system has been designed and several controllers have been tested (PD, PI or PID controllers) and calculated by error and trial methods. The PID Controller is best controlled undergo fine tuning to get the best performance.

REFERENCES
Level Process", World Academy of Science, Engineering and Technology 12 2005


