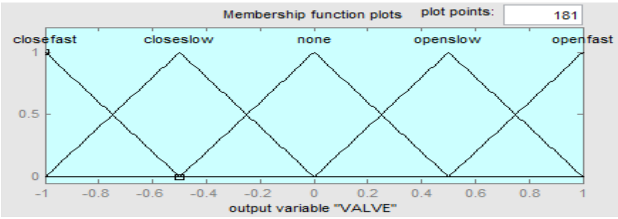

Figure 13: Output Membership Function Editor for valve

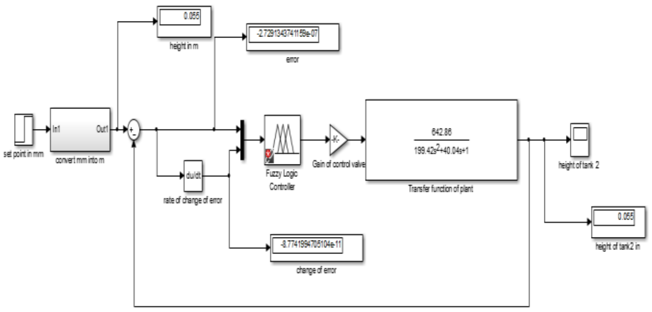

Figure 14: closed loop model with fuzzy controller for interacting tank

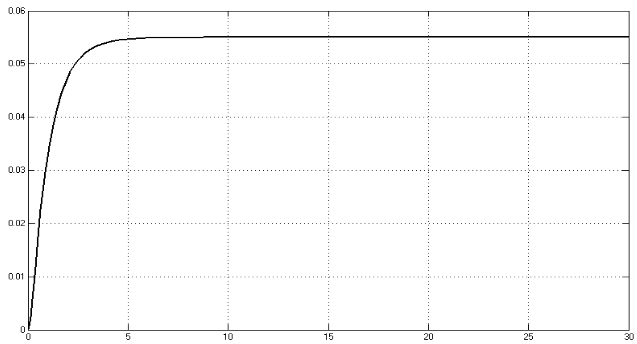

Figure 15: Simulation result for closed loop model with Fuzzy controller

6. Discussion

The FLC is applied to the plant described above in Fig.15 obtained FLC simulation results are plotted PI & PID controller for comparison purposes. The simulation results are obtained using a 25 rule FLC. Rules shown in Rule Editor. Here these rules are implemented to the above control system. For comparison purposes, simulation plots include PI & PID controller, and the fuzzy algorithm. FLC provide good performance in terms of oscillations and overshoot in the absence of a prediction mechanism. The FLC algorithm adapts quickly to longer time delays and provides a stable response while the PID controllers drives the system unstable due to mismatch error generated by the inaccurate time delay parameter used in the plant model. To strictly limit the overshoot, using Fuzzy Control can achieve great control effect. In this paper, we take the two tank interacting system, and use MATLAB to design a Fuzzy Control. Then we analyze the control effect and compare it with the effect of PID controller. As a result of comparing, Fuzzy Control is superior to PID control. Especially it can give more attention to various parameters, such as the time of response, the error of steadying and overshoot. Comparison of the control results from these systems indicated that the fuzzy logic controller significantly reduced overshoot and steady state error. Comparison results of PID and FLC are shown above.

The overall performance may be summarized as:

Table 4: Time response parameter comparison

Controller	Open loop	Close loop	PID	Fuzzy
Rise Time (s)	77.06	0.6056	6.6	33
Settling Time (s)	140.22	38.67	51.4	47.2
Overshoot (%)	-	83.87	28.69	1.45

7. Conclusion

In this paper, we developed the two tank interacting system mathematical model and simulated with PID controller and Fuzzy controller using MATLAB/Simulink. From the analysis of above table we conclude that two tank interacting system with PID controller gives relatively slow response with peak overshoot for unit step input. To achieve an optimum response without overshoot, we simulated the two tank interacting system with fuzzy logic controller with fuzzification and defuzzification techniques. The comparative analysis based on the simulation for two tank interacting system with fuzzy controller is tabulated which shows the superiority of fuzzy is more compare to PID. This analysis is useful especially for optimum level control in industries like food processing, petro chemical industries. As a future work one can develop design a FLC for a couple tanks system as adaptive Fuzzy Logic Controller like PID algorithm, which gives high performance for systems and high intelligence.

References

[1] L.ThillaiRani, N.Deepa, S.Arulselvi,“ Modeling and Intelligent Control Of two tank Interacting Level Process”, International Journal of Recent Technology and Engineering (IJRTE) ,ISSN: 2277-3878, Volume-3, Issue-1, March 2014.

[2] Abdelelah Kidher Mahmood , Hussam Hamad Taha , “Design Fuzzy Logic Controller for Liquid Level Control ”, International Journal of Emerging Science and Engineering (IJESE) ,ISSN: 2319–6378, Volume-1, Issue-11, September 2013

[3] Bhuvaneswari N S, Praveena R,Divya R , “System Identification And Modelling For Interacting And Non-Interacting System Using Intelligence Techniques ” , IJIST-2012 ,Volume-2,no-5,pp23-25, September 2012

[4] Dharamniwas , Aziz Ahmad , Varun Redhu , Umesh Gupta , “Liquid Level Control By Using Fuzzy Logic Controller ” , International Journal of Advances in Engineering & Technology (IJAET), ISSN: 2231-1963 , July 2012

[5] Gao Qingji, Li Zheng , “ Fast and Accurate Motion Control Based on Good Gain Method”, Telkomnika, Vol.11, No e-ISSN: 2087-278X , Volume-11, No.3, pp. 1236 ~ 1244 , March 2013,

[6] Li Qi , Fang Yanjun ,Song Jizhong ,Wang Ji , “The Application of Fuzzy Control in Liquid Level System”, International Conference on Measuring Technology and Mechatronics Automation , IEEE , ISSN : 978-0-7695-3962-1 , 2010

[7] Fuzzy Logic Toolbox User’s Guide ©COPYRIGHT 1995 - 1999 by The MathWorks, inc.