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Tuning PID on Cascade Control Level Deareator Steam Power Plant

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Abstract

Deaerator is an important component in the process of steam power plant, which serves to remove gases contained in boiler water. The level of the deaerator tank should be maintained in accordance with the specified set point. If the level is too low it will effect to disrupt the performance of the boiler feed pump. If the level is too high it will lead to overflow and disrupt the steam production process. This study discusses the analysis of Proportional-Integral-Derivative (PID) cascade control using tuning Ziegler-Nichols (ZN) and Tyerus Luyben (TL) methods to control deaerator level. The tuning parameter in the primary loop and the secondary loop will be varied on the cascade loop control is used to analyze the performance of PID control. To perform verification system, such as Peak Time (Tp), Overshoot (Mp), Error Steady State (ESS) and Settling Time (Ts) a simulink Matlab is proposed. Four tuning PIDs on the cascade loop are: ZN-ZN, ZN-TL, TL-TL, TL-ZN get results that are able and get stability to follow the set point level. Tuning PID TL-TL method has the most ideal response result in use for deaerator level control at steam power plant because it has the lowest overshoot response of all three other cascade loop tuning methods. The transient response system has obtained values Tp=2,06 seconds, Mp=22,23%, Ess=0,7%, Ts=13,54 seconds.

Keywords: *Level, Deaerator, Cascade Control, Tuning PID*

1. Introduction

Steam power plant processing O_2 and CO_2 gas dissolved in condensate water, it will potentially create corrosion of boiler pipes. To avoid this, a deaerator is used as a tool to remove gases contained in boiler water after a demineralized process [1]. In addition, deaerator also serves as an initial condensate water heater before entering into the boiler pipes [2]. Deaerator works based on the nature of oxygen whose solubility in water will decrease when the temperature increasing. Main functions to determine the success of the process in the deaerator is the physical contact between the water condensate material and the heat supplied by the vapor. If the deaerator does not work properly, it can adversely affect boiler water systems, condensate systems and increased the use of chemicals to prevent dissolved oxygen content. With the process of heating in the deaerator, it will change the volume of water in it. Therefore, it is necessary to control the system level and flow condensate so that the temperature is stable according to the process that has been determined [3].

Load changes and disturbance also greatly affect on system dynamics. A good control system should be able to maintain system stability despite changes in control parameters, since a closed loop system that has feedback is uncertain. The stable system will get the specification of the system, including steady state, percent overshoot, settling time, peak time and rise time [4].

Deaerator level control has been developed by most researchers include in : making design of level control and pressure deaerator using decoupler then compare response result of control method of PID, IMC, FLC, Fuzzy-PID using matlab [1]. Design of MIMO control (level and pressure) and using decoupler to avoid when set level changes affect pressure deaerator [2]. Design of deaerator level controller system using fuzzy gain scheduling - PI method, based on the simulation is known that the fuzzy controller gain scheduling - PI has a better output response compared to a PI controller [3]. However, these studies are focused on controlling cascade system and analyzing system response by applied tuning PID parameters with variations using

Zieger Nichlos and Tyerus Luyben method on loop cascade deaerator level and simulated using matlab simulink.

2. Research Method

Deaerator tank process is apply the law of conservation of energy which the incoming energy equals energy out [3].

$$[\text{The mass energy stored}] = [\text{mass energy entered}] - [\text{mass energy out}]$$

$$\rho\frac{\delta v}{\delta t} = (Fw.\rho i + ms) - Fo.\rho o \qquad (1)$$

It is known that the fluid level at normal operations with the set point of 2.7 m - 3.05 m, diameter of the tube is 3,2 m and the tube length is 12,45 m, we get δv = 16,84 δh, new equations are generated as follows [3] :

$$16{,}84\,\frac{\delta h\prime}{\delta t} = Fi' + \frac{1}{\rho}.ms' - \frac{K}{2\sqrt{h}}\,h' \qquad (2)$$

If the equation is simplified, the transfer function of the process will be obtained:

$$h' = \frac{2\sqrt{\text{h}}\,/\,\text{K}}{(2\sqrt{\text{h}}\,/\,\text{K})\ 16{,}84\ s+1}\,Fi' + \frac{2\sqrt{\text{h}}\,/\,K.\rho}{(2\sqrt{\text{h}}\,/\,\text{K})\ 16{,}84\ s+1}\,ms' \qquad (3)$$

$$H(s) = \frac{Gp}{T_p\,s+1}\,Fi' + \frac{Gm}{T_p\,s+1}\,ms' \qquad (4)$$

with : Gp (gain of the flow condensate) = 2√h / K
Gm (gain mass of steam) = 2√h / K.ρ
T_p (time constant) = (2√h / K) 16,84

Based on the data operations, with a setpoint value of 0 mm (Normal Water Level), the value of h= 2,875 m, with K = 1 and ρ water = 1000 kg / cm3, then the transfer function of deaerator tank [3] :

$$H(s) = \frac{3{,}39}{57{,}09\,s+1}\,Fi'(s) + \frac{0{,}003}{57{,}09\,\text{s}+1}\,ms'(s) \qquad (5)$$

$$\frac{\text{H (s)}}{\text{F (s)}} = \frac{3{,}39}{57{,}09\,s+1}$$

The transfer function of transmitter approached by first order system according to the Eq. (6) [3].

$$\frac{\text{L}_\text{L}\text{ (s)}}{\text{I}_\text{L}\text{(s)}} = \frac{\text{G}_\text{L}\ (Gain)}{\text{T}_\text{c}\text{(Time Constan) (s) +1}} \qquad (6)$$

Based on the specification data, the transfer function of the level transmitter according to the Eq. (7).

$$\frac{L_L\,(s)}{I_L(s)} = \frac{5}{0{,}16s+1} \qquad (7)$$

Based on the specification data, the transfer function of the flow transmitter according to the Eq. (8).

$$\frac{\text{L}_\text{L}\text{ (s)}}{\text{I}_\text{L}\text{(s)}} = \frac{0{,}072}{0{,}16\text{s}+1} \qquad (8)$$

The transfer function of the hydraulic servo valve coupling drive can be approximated by using first order system as shown in Eq. (9) [3]..

$$\text{Gcv} = \frac{\text{Kc}}{\text{T}_{\text{cv(Time Constan Valve)}}\ \text{s}+1} \qquad (9)$$

The transfer function of the hydraulic servo valve coupling drive is shown in Eq. (10).

$$\frac{Q\ (s)}{U\ (s)} = \frac{13{,}88}{1{,}5\,s+1} \tag{10}$$

All of part transfer function in models of cascade level deaerator is shown in Figure 1.

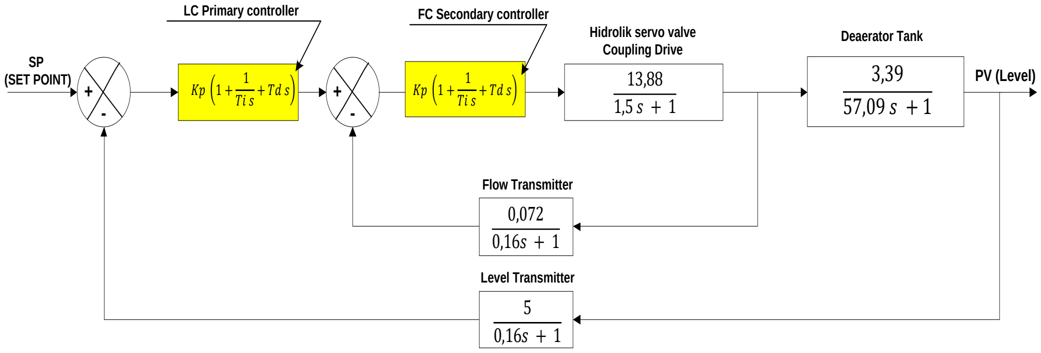


Figure 1. Modeling System Control Cascade Deaerator

The characteristics of PID controllers are strongly influenced by the large contribution of the three parameters Proportional, Integral and Derevative. Setting the Kp, Ti and Td constants values will resulting in reinforcing the properties of each element. The PID algorithm can be defined as shown in Eq. (11) [12].

$$Gc(t) = Kp\left\{e(t) + \frac{1}{T_i}\int e(t)dt + T_d\frac{d}{dt}e(t)\right\} \tag{11}$$

The deaerator level control system uses a PID controller type. To determine the value of PID element which includes the value of Kp, Ti and Td used cascade control system approach by tuning the primary loop (master) and the secondary loop (slave). In the Ziegler-Nichols and Tyerus Luyben closed-loop tuning method, to obtain the ultimate gain (Kcr) and the ultimate period of oscillations (Pcr) is to calculate Kc. To determine the value of Kc, the value of the proportional gain that will produce a steady oscillation in the system is first obtained.The gains for the integrator and the derivative controllers are initially set at zero for the procedure. When the systems oscillates steadily, the period of oscillation must therefore be obtained as it is required in calculating the integral and derivative times. The ultimate period is the time required to complete one full oscillation while the system is at steady state.

In addition to the above procedure, the value of Kc can also be obtained by using the stability criterion routh. From the criterion of stability of routh we can get the value of Kcr and Pcr from the equation characteristic of the transfer function denumerator. Table 1 is shown tuning PID formula for Ziegler-Nichols method, while Table 2 is shown tuning PID formula for Tyerus Luyben method.

Table 1. Tuning PID Ziegler-Nichols Ocillation Method [12].

Controller	K_p	T_i	T_d
P	0,5 Kcr	-	-
PI	0,4 Kcr	0,8 Pcr	-
PID	0,6 Kcr	0,5 Pcr	0,12 Pcr

Table 2. Tuning PID Tyerus-Luyben Method [12].

Controller	K_p	T_i	T_d
PI	0,3125 Kcr	2,2 Pcr	-
PID	0,4545 Kcr	2,2 Pcr	0,159 Pcr

The research methodology of PID tuning cascade control level deaerator can be explained in the flow diagram as shown in Figure 2.

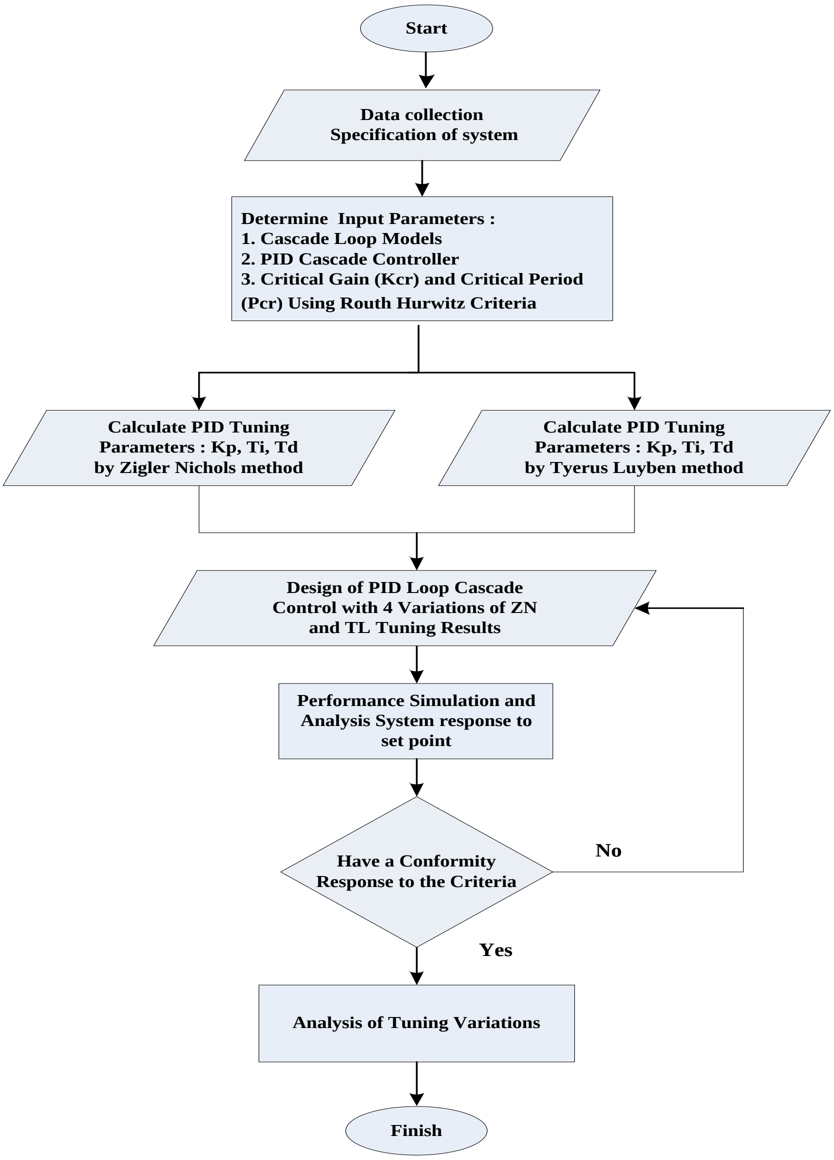


Figure 2. Flow Chart of The Research Method

3. Result and Analysis

3.1. Open Loop System Test

Open loop test is purpose to know the overall system characteristics with the controller positioned in manual mode. Graph simulation open loop response is shown in Figure 3.

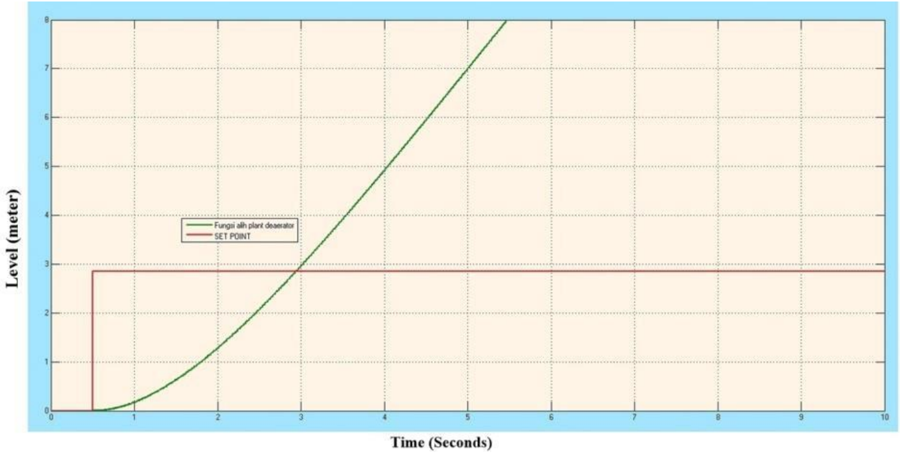


Figure 3. Open Loop Response

From the step signal test results, an input signal of 2,85 m and deaerator level is expected to reach a maximum value of 2,85 m, but the deaerator level exceeds the specified set point. Based on this it is known that without any controller or if the controller is positioned in manual mode without human supervision then, there will be overflow on the deaerator tank and endanger the process of electricity generation in steam power plant.

3.2. Tuning PID Parameters

Calculation characteristic of the secondary loop transfer function system as shown in Eq. (12).

$$\frac{PV\ (s)}{SP\ (s)} = \frac{Kp\left(1+\frac{1}{Ti\ s}+Td\ s\right)\ \frac{13{,}88}{1{,}5S\ +\ 1}}{1+Kp\left(1+\frac{1}{Ti\ s}+Td\ s\right)(\frac{13{,}88}{1{,}5S\ +\ 1})(\frac{0{,}072}{0{,}16S\ +\ 1})}$$

$$\frac{PV\ (s)}{SP\ (s)} = \frac{2{,}22Kp\ s+13{,}88\ Kp}{0{,}24\ s^2\ +\ 1{,}66\ s\ +(1+0{,}9994\ Kp)}$$

From the calculation it have equation characteristic on denumerator :

$$0{,}24\ s^2 + 1{,}66\ s + (1+0{,}9994\ Kp) \qquad (12)$$

The stability of the system can be determined by routh stability criterion as in Table 3. It is a mathematical test that is a necessary and sufficient condition for the stability of a linear time invariant (LTI) control system. Table 3 show the routh array table for the transfer functions of the secondary loop as in Eq. (12) based on the characteristic equation.

Table 3. Routh Array Criteria on Secondary Loop

S^2	0,24	1+0,9994 Kp
S^1	1,66	0
S^0	1+0,9994 Kp	0

The stability requirement of the Routh analysis is when all coefficients of the first column of the Routh series are positive.

1+0,9994 Kp, then 1+0,9994 Kp > 0

secondary loop is a stable system on S^0 with the value of Kp is 0 < Kp < 1,0006. To calculate Pcr then the characteristic equation of Routh, the value of “s” is replaced by jω with the value of Kcr = 1,0006.

$$0{,}24\ (j\omega)^2 + 1{,}66\ (j\omega) + (1+0{,}09994 \times 10{,}006) = 0$$

$$-\,0{,}24\,\omega^2 + (1+0{,}9994) + j\,2{,}04\,\omega = 0$$

with, $$\omega = \sqrt{\frac{1{,}9994}{0{,}24}} = 2{,}89 \text{ rad/sec}$$

$$Pcr = \frac{2\,\pi}{\omega} = 2{,}173 \text{ seconds}$$

Based on Table 1 and Table 2 we specify tuning parameter PID for secondary loop (flow controller) with value Kcr = 1,0006 and Pcr = 2,173. The result tuning PID on secondary loop is shown in Table 4.

Table 4. Calculation Tuning PID Zieger Nichlos and Tyreus Luyben method for secondary loop cascade

Criteria Routh	*Ziegler-Nichols* PID *Controller*	*Tyreus-Luyben* PID *Controller*
Kcr = 1,0006	Kp = 0,6	Kp = 0,46
Pcr = 2,173	Ti = 1,09	Ti = 4,78
	Td = 0,26	Td = 0,34

Calculate the secondary loop equation in the controller, by entering the value Kp = 1, Ti = 1 and Td = 1 to construct the primary loop equation. the primary loop transfer function system result as shown in Eq. (13).

$$\frac{\mathrm{PV}\,(s)}{\mathrm{SP}\,(s)} = \frac{2{,}221\,\mathrm{s}^3 + 16{,}1\,\mathrm{s}^2 + 16{,}1\,\mathrm{s} + 13{,}88}{0{,}2398\,\mathrm{s}^5 + 1{,}899\,\mathrm{s}^4 + 2{,}898\,\mathrm{s}^3 + 2{,}658\,\mathrm{s}^2 + 0{,}9994\,\mathrm{s}} \tag{13}$$

The secondary loop equation has been resolved, after which simplification of the primary loop equation is done by simply entering the value of Kp and omitting the Ti and Td values. So the determination of critical Kp value (Kcr) of the system can be done as shown in Eq. (14).

$$\frac{PV\,(s)}{SP\,(s)} = \frac{Kp\ \left(2{,}221\,s^3 + 16{,}1\,s^2 + 16{,}1\,s + 13{,}88\right)(3{,}39)(0{,}16\,s+1)}{1+\frac{37{,}64\,s^3\,Kp + 272{,}9\,s^2\,Kp + 272{,}9\,s\,Kp + 235{,}3\,Kp}{2{,}191\,s^7 + 31{,}08\,s^6 + 135{,}4\,s^5 + 192{,}1\,s^4 + 164{,}2\,s^3 + 59{,}87\,s^2 + 0{,}9994\,s}} \tag{14}$$

the characteristic system on denumerator Eq. (14) that shown in Eq. (15).

$$Sp(s) = 2{,}191\,s^7 + 31{,}08\,s^6 + 135{,}4\,s^5 + 192{,}1\,s4 + (164{,}2\,s^3 + 37{,}64\,s^3\,Kp) + (59{,}87\,s^2 + 272{,}9\,s^2\,Kp) + (0{,}9994\,s + 235{,}3\,s\,Kp) \tag{15}$$

From the equation above is used routh criteria method to determine the value of Kcr.

Table 5. Routh Array Criteria on Primary Loop

S^7	2,191	135,4	164,2 + 37,64 Kp	0,999 + 235,3 Kp
S^6	31,08	192,1	59,87 + 272,9 Kp	0
S^5	121,86	159,97 + 18,4 Kp	0,999 + 235,3 Kp	0
S^4	151,31 - 4,7 Kp	59,6 + 212,8 Kp	0	0
S^3	$\frac{4{,}692e12\ Kp^2 + 1{,}299e15\ Kp - 9{,}203e14}{2{,}55e11\ Kp - 8{,}219e12}$	0,999 + 235,3 Kp	0	0
S^2	$\frac{1{,}507e32\ Kp^4 + 2{,}558e34\ Kp^3 - 9{,}606e35\ Kp^2 - 6{,}665e35\ s + 2{,}034e35}{5{,}521e29\ Kp^3 + 1{,}35e32\ Kp^2 - 5{,}035e33\ s + 3{,}491e33}$	0	0	0
S^1	0,999 + 235,3 Kp	0	0	0
S^0	0	0	0	0

According to the routh criteria, the system will be stable if all elements in the first column of the routh table are positive. Based on the table S^4, system stable if Kp > 0 and (151,31 - 4,7 Kp) > 0, then the primary loop can be known the value of Kcr.

$$151{,}31 - 4{,}7\ Kp > 0$$

$$32{,}19 > Kp$$

Primary loop is a stable system at 0 <Kp <32,19. With Kcr = 32,19, it would be zero at line S^5 of the routh array or otherwise Kcr = 32,19 this would cause the continuous self oscillation in closed loop systems. For Kcr = 32,19 special auxiliary polynomial is given by the S^4 line coefficients:

$$121{,}86\ s^5 + (159{,}97 + 18{,}4\ Kcr)\ s^3 + (0{,}999 + 235{,}3\ Kcr)\ s = 0$$

$$121{,}86\ s^4 - 752{,}266\ s^2 + 7575{,}306 = 0$$

$$121{,}86\ s^2 = 742{,}88 \text{ by giving the roots :}$$

$$s = \pm j\omega\ \sqrt{\frac{742{,}88}{121{,}86}} = j\omega_0$$

The frequency of self oscillation (continuous oscillation) is Kcr = 32,19:

$$\omega\ = \sqrt{\frac{742{,}88}{121{,}86}} =\ 2{,}47\ rad/sec.$$

So the value of the base period is :

$$Pcr\ =\ \frac{2\,\pi}{\omega}\ =\ \frac{2\ x\ 3{,}14}{2{,}47} =\ 2{,}54 \text{ seconds}$$

Based on table 2 and table 3 we can determine the tuning parameter of PID for primary loop level controller with value Kcr = 32,19 and Pcr = 2,54.

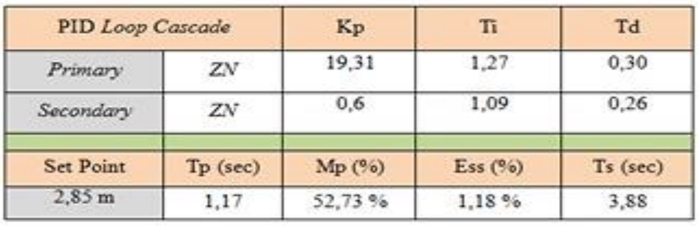
Table 6. Calculation Tuning PID Zieger Nichlos and Tyreus Luyben method for Primary Loop

Criteria Routh	*Ziegler-Nichols* PID *Controller*	*Tyreus-Luyben* PID *Controller*
Kcr = 32,19 Pcr = 2,54	Kp = 19,31	Kp = 14,63
	Ti = 1,27	Ti = 5,59
	Td = 0,30	Td = 0,40

3.3. Simulation and Analysis Performance of Variation Tuning PID Loop Cascade

Simulation were done by Matlab/Simulink, there are 4 variations of PID parameter tuning result that is simulated to get the best result from system control reponse. ZN - ZN loop cascade, ZN - TL loop cascade, TL - TL loop cascade, TL - ZN loop cascade.

Table 7. Performance PID Parameters ZN - ZN Loop Cascade



PID *Loop Cascade*		Kp	Ti	Td
Primary	*ZN*	19,31	1,27	0,30
Secondary	*ZN*	0,6	1,09	0,26
Set Point	Tp (sec)	Mp (%)	Ess (%)	Ts (sec)
2,85 m	1,17	52,73 %	1,18 %	3,88

Table 8. Performance PID Parameters ZN – TL Loop Cascade

PID *Loop Cascade*		Kp	Ti	Td
Primary	*ZN*	19,31	1,27	0,30
Secondary	*TL*	0,46	4,78	0,34
Set Point	Tp (sec)	Mp (%)	Ess (%)	Ts (sec)
2,85 m	1,43	44,1 %	0,17%	4,95

Table 9. Performance PID Parameters TL – TL Loop Cascade

PID *Loop Cascade*		Kp	Ti	Td
Primary	*TL*	14,63	5,59	0,40
Secondary	*TL*	0,46	4,78	0,34
Set Point	Tp (sec)	Mp (%)	Ess (%)	Ts (sec)
2,85 m	2,06	22,23 %	0,7 %	13,54

Table 10. Performance PID Parameters TL – ZN Loop Cascade

PID *Loop Cascade*		Kp	Ti	Td
Primary	*TL*	14,63	5,59	0,40
Secondary	ZN	0,6	1,09	0,26
Set Point	Tp (sec)	Mp (%)	Ess (%)	Ts (sec)
2,85 m	1,51	28,77 %	0,7%	12,35

There is comparison performace response from variations of tuning PID loop cascade :

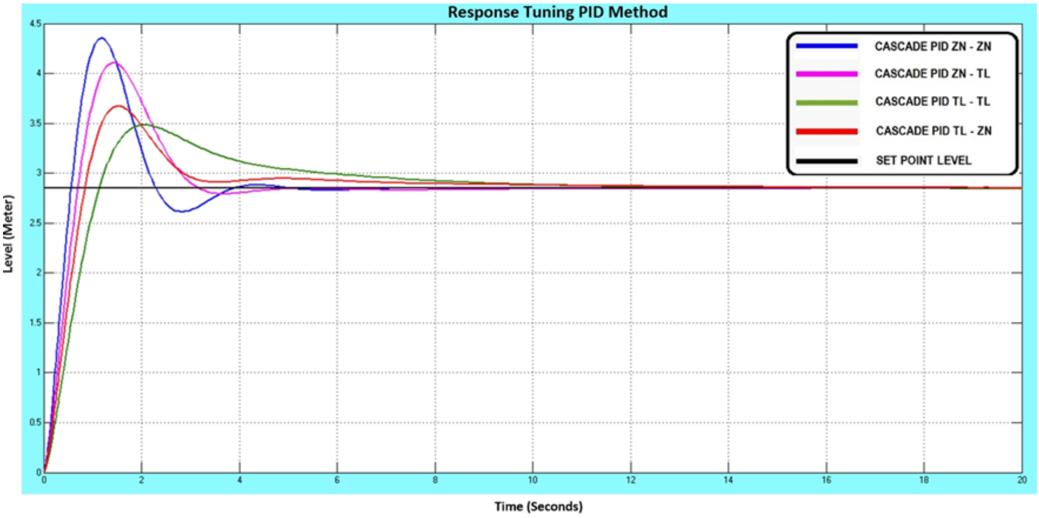


Figure 4. Response Control System with Variation Tuning PID Loop Cascade

Table 11. Comparison of Transient Response Variation Tuning PID Loop Cascade

PID *Loop Cascade Method*		Tp (sec)	Mp (%)	Ess (%)	Ts (sec)
Set Point Level	*Tuning*				
2,8 m	*ZN - ZN*	1,17	52,73 %	1,18 %	3,88
	ZN - TL	1,43	44,1 %	0,17%	4,95
	TL - TL	2,06	22,23 %	0,7 %	13,54
	TL - ZN	1,51	28,77 %	0,7%	12,35

The highest overshoot (Mp) result is obtained on the control using ZN- ZN tuning method which is 52,73 %. High overshoot due to proportional control characteristic on tuning ZN-ZN primary and secondary loop has higher value compared to other tuning result. The advantage of ZN-ZN tuning method is at the fastest settling time of 3,88 seconds. On the response control using TL-TL tuning method produces the lowest overshoot (Mp) of 22,23 %, but has a lack of a slower time setting of 13,54 seconds. The low Overshoot (Mp) of the TL-TL tuning method results is influenced by time integral and time derivative parameters whose value is higher than the ZN-ZN tuning method. The effect of high value integral time will slow down the time setting to steady state of the system response. From various comparative system responses and performance criteria analysis to the effect of hydraulic coupling condensate pump actuator response, the PID control of TL-TL tuning method result is smaller overshoot with settling time 3,5 times slower than ZN-ZN tuning is more appropriate. On the TL-TL tuning method with lower Overshoot (Mp) characters are more needed in deaerator system control.

4. Conclusion

In order to control the level of deaerator, a conventional PID controller has been implemented. The parameter of the PID controller can be tuned by the traditional method as ZN and TL. Using Matlab simulink simulation model, simulation result from tuning PID cascade level deaerator got the best response performance value on TL-TL PID parameter tuning method with loop cascade primary loop (TL) is Kp = 14,63 Ti = 5,59 Td = 0,40 and cascade secondary loop (TL) is Kp = 0,6 Ti = 1,09 Td = 0,26. Transient response performance on TL-TL Tuning is Tp = 2,06 seconds, Mp = 22,23%, Ess = 0,7%, Ts = 13,54 seconds. The lowest overshoot (Mp) value matches plant characteristics requiring stability of the control when a set point change and process interruption occur.

References

[1] S.Gomathy, Mrs.T.Anitha, "*Deaerator Storage Tank Level & Deaerator Pressure Control Using Soft Computing", IJSART - Volume 1 Issue 5 –MAY 2015. ISSN [ONLINE]: 2395-1052.* 2015.

[2] Hafyz Iqbal. Hendra Cordova, "*MIMO Design control (level and pressure) Deaerator unit using decoupler*", Departement of Engineering Physics FTI ITS Surabaya.

[3] Ariyanto, Syamsul Arifin, M. Ilyas, "*Perancangan Sistem Pengendali Level Deaerator Menggunakan Fuzzy Gain Scheduling – PI Di PT Petrowidada*", Departement of Engineering Physics FTI ITS Surabaya.

[4] H.I Jaafar, S.Y.S Hussien, N.A Selamat, M.S.M Aras, M.Z.A Rashid, "*Development of PID Controller for Controlling Desired Level of Coupled Tank System*", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075. Volume-3. Issue-9 February 2014.

[5] T. Lakshmi Priyanka, K.R.S. Narayanan, T.Jayanthi, S.A.V. Satya Murty, "*Simulation and Tuning of PID Controllers using Evolutionary Algorithms*", I.J. Information Technology and Computer Science, 2012.

[6] Ikpe Aniekan E, Owunna Ikechukwu, Satope Paul, "*Comparative Analysis of a PID Controller using Ziegler Nichols and Auto Turning Method*", International Academic Journal of Science and Engineering Vol. 3. No. 10. 2016.

[7] Min Xu, Shaoyuan Li, Wenjian Cai, "*Cascade generalized predictive control strategy for boiler drum level*", Institute of Automation, Shanghai Jiao Tong university, Shanghai.

[8] [8] Dery Dwi Hananto, *"Perancangan Sistem Pengendalian Level pada HP Feedwater Heater dengan*

[9] *Metode Cascade dan Override di PT.IPMOMI Paiton Jawa Timur",* Jurusan Teknik Fisika (ITS).

[10] Niqris Prihantya, Hendra Cordova, Ronny Dwi Noriyati, "*Perancangan Sistem Pengendalian Level dan Interlock Pada Steam Drum Dengan Tiga Elemen Kontrol di PG, Gempolkrep – Mojokerto*", Jurusan Teknik Fisika, Fakultas Teknologi Industri, Institut Teknologi Sepuluh Nopember (ITS) JURNAL TEKNIK POMITS Vol. 2. No. 1. (2013) ISSN: 2337-3539.

[11] Ogata, Katsuhiko. 1970. Modern Control Engineering. New Jersey: Prentice Hall.

[12] Gunterus, Frans, Falsafah Dasar: Sistem Pengendalian Proses. jakarta: PT. Elex Media Komputindo, Jakarta 1994.
[13] Abdul Wahid, *Pengendalian Proses*, Diktat Jurusan Teknik Kimia, Fakultas Teknik Universitas Indonesia, Depok 2004.
[14] SSPP 200 MW Unit 3 Instruction Book for Condensate Pumps. Data Teknis PLTU 3 PT Indonesia Power Tambak Lorok Seamarang.