

Assignment 1 Josh Beer

by Joshua Beer

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**Control and
Instrumentation**

Control System Analysis, Modelling, Simulation and Practical Testing

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1. Introduction

The aims of this assignment are to investigate by simulation and by practical experiment, a second order control system and its associated instrumentation.

The objectives of this assignment are as follows:

- To be able to develop a mathematical model of a second-order dynamic system using a transfer function from a process reaction curve.
- To be able to use a simulation package and process control system to examine the response of the system to a step input test signal.
- Research into the characteristics of a range of flow transducers incorporated into an instrumentation system.
- Process reaction curve method of tuning a PID controller.

The assignment will use the Bytronic Process Rig in the G8 lab where flow can be measured and controlled.

2. Research

What is Flow?

Flow is the amount of liquid or gas which passes through a certain point in a given time. For example if 1m cubed of water passed through a certain point and it took one hour to do so then the flow rate is going to be 1m cubed per hour. There are other factors which determine flow and these are the area of the pipe in which they are flowing and the pressure behind the flow.

If a large volume of liquid/gas is flowing through a small pipe then this will give the flow a large pressure but if the same amount of volume was flowing through a large pipe at the same rate the pressure would be less.

How to Measure Flow

Flow can be measured in a number of different ways, below is a range of different transducers and how each one works to calculate flow.

Differential pressure flowmeter:

This works using the ^{spelling} principal that changing the area of the pipe and thus reducing the area in which the liquid/gas is flowing will create a pressure drop across the restriction. This means that there will be a differential pressure drop before and after the restriction.

This can then be used to calculate flow as there is a relationship between pressure and flow. If there is a very large pressure at the first impulse line compared to the second impulse line then there will likely be a large flow going through the pipe. This of course could be incorrect if the either of the impulse lines were blocked.

If there was a smaller pressure difference then there would be less of a flow in the line. The line could still have a very big pressure in it though as the flowmeter is only measuring the differential pressure between these two impulse lines.

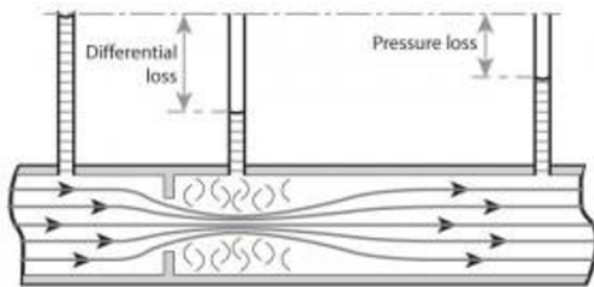


Figure 1 - Differential Pressure Flowmeter (differential-pressure-flow-meters-dp-flow-meters/)

Figure 1 shows the differential pressure loss across the reduction in the pipe.

Differential pressure flowmeters use Bernoulli's principle, this formula is show below;

$$H = z + \frac{p}{\rho g} + \frac{v^2}{2g} = h + \frac{v^2}{2g}$$

Where H = total head

v = the fluid flow speed at a point on a streamline,

g = the acceleration due to gravity,

z = the elevation of the point above a reference plane, with the positive z -direction pointing upward – so in the direction opposite to the gravitational acceleration,

p = the pressure at the chosen point, and

ρ = the density of the fluid at all points in the fluid.

This formula uses a square root extraction which means that any flow seen by the differential pressure will have to be square rooted at the control panel to display the true flow rate. This means that for low differential pressures the flow rate could become inaccurate as the resolution is 100:1.

(differential-pressure-technology)

There are different types of differential pressure transducers and these include:

- Venturi flow meter
- Orifice plate
- Pilot tubes
- Pressure transmitter are then used to measure and convey the flow.

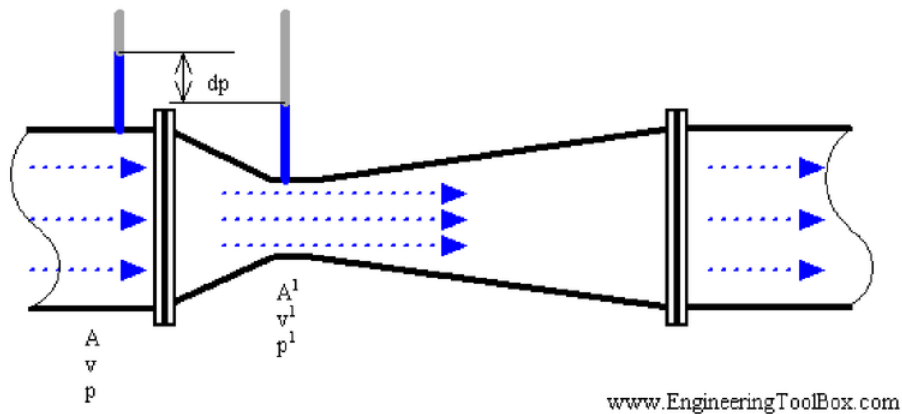
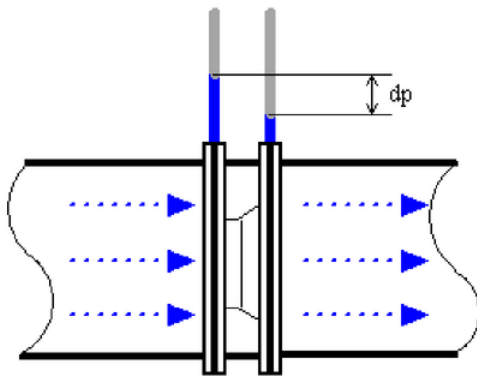


Figure 2 - Venturi Flow Meter (engineeringtoolbox)

Figure 2 shows the venturi flow meter which creates a pressure drop across the restriction in the pipe, it is then gradually increased back to its normal area. This is important because it reduces the amount of vortex created and therefore can recover up to 90% of the pressure drop.

Venturi meters are more accurate and therefore more expensive than other types of devices, they reduce the risk of the restriction getting plugged and can be fitted horizontally or vertically. (Praveen; Advantages and Disadvantages of Orifice Meter and Venturi Meter, 2018)



www.EngineeringToolBox.com

Figure 3 - Orifice Plate (engineeringtoolbox)

Figure 3 shows the orifice plate which creates a pressure drop across the restriction it creates in the pipe, unlike the venturi it doesn't gradually change diameter back to the original size and therefore will create lots of turbulence in the flow disruption the pressure and causing it to drop.

Orifice plates are cheap to produce and are still quite accurate when first installed by they can easily become blocked and/or worn down over time, thus reducing the accuracy of the readings.

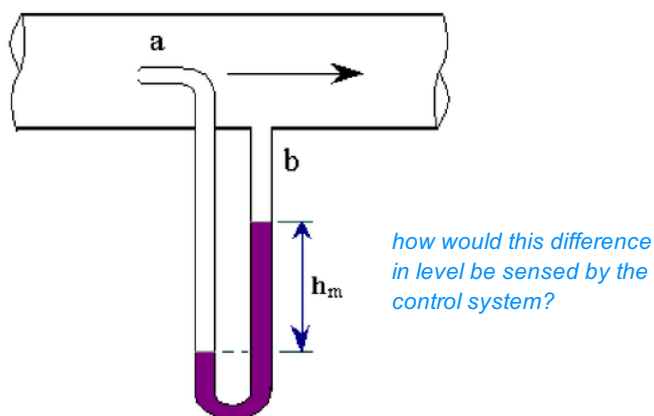


Figure 4 - Pilot Tubes (Msubbu)

Figure 4 shows a Pilot tube which is using displacement of liquid to measure the change in flow. The bigger the difference in distance between liquid the bigger the flow and vice versa.

Pilot tubes are cheap and effective but not very accurate. They show how the flow is reacting but cannot show how much volume per minute as they are closed systems.

Turbine flow meters:

Turbine flow meters work by picking up ^{spelling} pulses from the turbine which is turning. There will be a certain number of pulses per revolution of the turbine and therefore the PLC will know how many revolutions per minute equals what volume of liquid/gas is flowing.

This will then use the value output by the PLC and use this as an analogue signal to tell the operator how much volume per minute is flowing. These are highly accurate pieces of instrumentation and therefore are used for crucial measurement in industry.

For example, in refining a turbine flow meter will be used to count the volume of product being received from tankers. This ensures that the refinery is getting the exact volume it has asked for. These meters are then proved and calibrated with data to back this up.

To prove a turbine flow meter an exact known quantity of liquid will be passed through the meter in a known time (1 m cubed in 1 hour), if the meter then shows 1 m cubed has passed through in that hour then the meter is accurate and can be used.

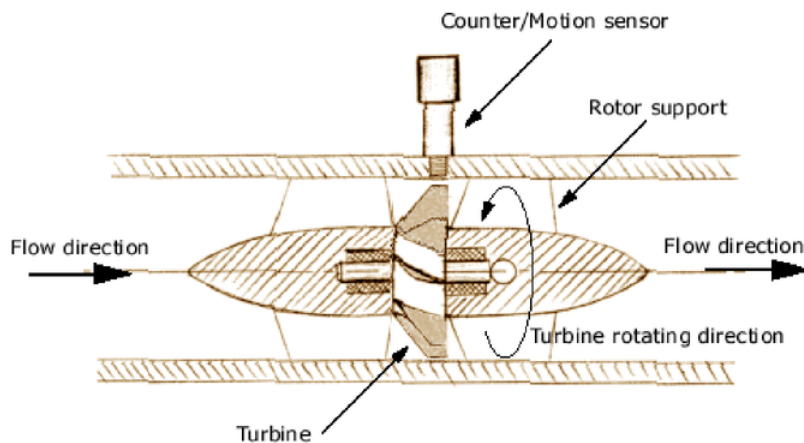


Figure 5 - Turbine Flow Meter (Globalspec)

Figure 5 shows the inner working of a turbine flow meter and how the amount of pulses are counted using a pulse detector.

How do Transducers Work?

Transducers work by turning a physical signal into a digital/analogue signal which can be read by a PLC or system and then show a value to the physical signal.

So for the differential pressure the transmitter will be reading a pressure between a specific range for 0-100% flow. The cell inside the transmitter will be calibrated to know that for example 0Kg of pressure is 0 flow and 1Kg of pressure is 100% flow, as mentioned above this relationship is not linear and will be square root extracted further down the line. The transmitter will then output a given analogue signal for 0% (usually 4mA for long distance travel and 0V for small distances) and another value for 100% flow (20mA or 5V), this has then converted the physical signal into an analogue signal. This analogue signal can now be square root extracted and shown as a flow on the control panel.

Using the turbine meter is more complex as the pulses counted will be input to a PLC and the PLC will have a program knowing how many pulses per revolution and time will mean how much volume is being transferred. The PLC will then output the analogue signal which will then be shown as a flow on the control panel.

This is called signal conditioning.

Bytronic Process Rig

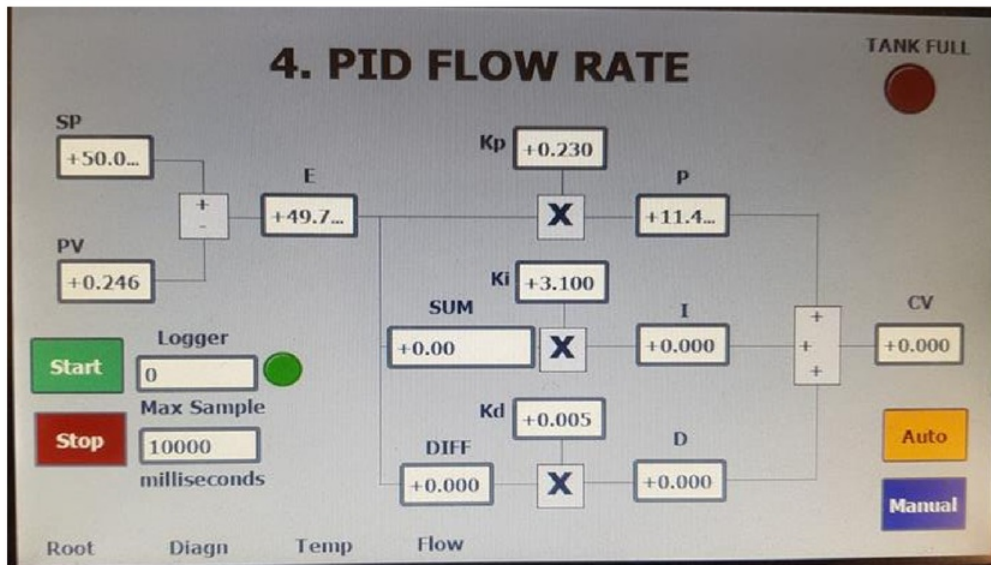


Figure 6 - Bytronic Rig PLC Flow Measurement

Figure 6 shows the Bytronic rig flow rate as a PLC screen, this is used as the flow measurement system and part of the control loop for the rig.

It shows the set point which is entered and the process variable along with the Kp, Ki, Kd and P, I and D values.

These values are used to keep the set point and the process variable as close as possible with as little overshoot and oscillation as possible.

The rig uses a rotameter flow meter similar to the turbine flow meter described above in research. It uses 6 pulses per revolution and has a maximum output of 2 litres per minute. Therefore the PLC will know this and will be able to count the rotations per second and per minute to be able to work out the flow rate which will then be displayed and fed back onto the screen as the PV.

The SP is then entered to fill the tank over a certain amount of time and the flow rate will decide how fast or slow the pump is cutting in/out to allow the tank to fill accordingly.

This is incorrect. The pulses are fed into an F to V chip which converts

Caldwell Modelling Method:

Using the Caldwell method of modelling the process reaction curve is produced using a second order system. The formula is as follows:

$$G(s) = \frac{1}{(t_1s + 1)(t_2s + 1)}$$

From the curve t_1 and t_2 can be found as 73% of the curve = $t_y = (t_1 + t_2)$. *Incorrect, you must also divide by 1.32*

Therefore fractional response time is calculated as $\frac{t_1+t_2}{2}$

Where is the Caldwell graph?

Then the value $\frac{t_2}{t_1+t_2}$ can be found and t_1 can then be found by rearranging the formula.

Ziegler-Nichols Method:

The Ziegler-Nichols method of modelling uses K_p , K_i and K_d to produce a way of tuning a PID controller.

Using open loop control (meaning there is no feedback) the tuning starts with only the value for K_p (path gain). The value of K_p is then increased until the system output is sustainably oscillating (critical gain). Once this value has been achieved it should be input to the table below and values for K_i and K_d calculated to use for the PID controller. *This is incorrect, you are describing the ultimate cycle method not the process reaction method, hence you are referring to the critical gain which does not relate to the method used in this assignment.*

Control Mode	K_p	K_i	K_d
P	$\Delta c/RL$		
PI	$0.9 * \Delta c/RL$	$K_p/3.33L$	
PID	$1.2 * \Delta c/RL$	$K_p/2L$	$0.5 * K_pL$

Figure 7 - Ziegler-Nichols Table

These values can then be used in the P, PI and PID control methods.

If you had described the correct method, you would have been able to explain the meaning of the terms R, L and delta c.

3. Flow Control System Modelling, Simulation and Testing

3.1 Caldwell Method of Simulation

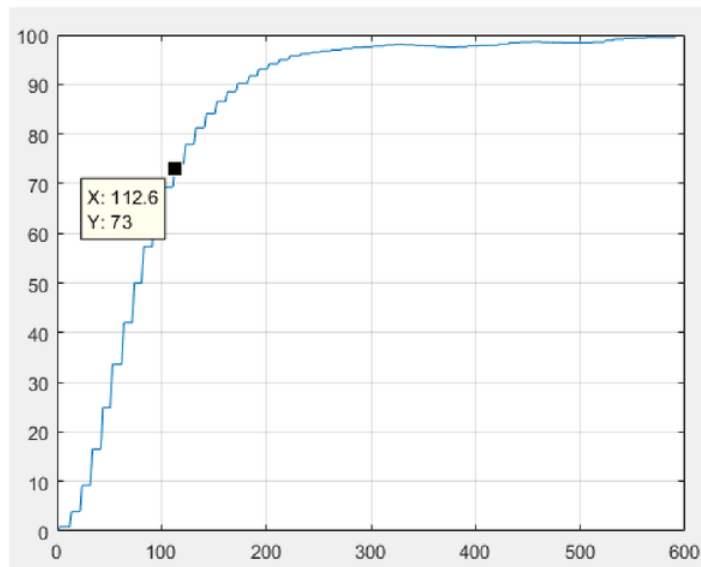


Figure 8 - Caldwell Method 73%

73 % = 112.6

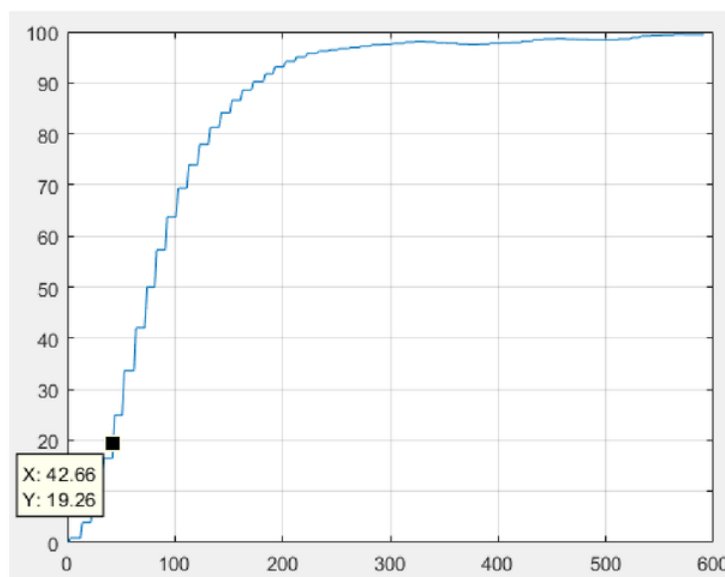


Figure 9 - Caldwell Method (2)

$T1 + t2 = 112.6/2 = 85.3$ *This is incorrect as you have left out the 1.32 factor (112.6/2 = 56.3) yet you have produced the correct result*
 $T1 + t2 / 2 = 42.65$ *brackets are needed here (112.6/2 = 56.3) yet you have produced the correct result*

From response $x = 0.1926$

$T2 / t1 + t2 = 0.5$ *brackets are needed here also.* No explanation given as to where the 0.5 comes from
 $T1 \text{ and } t2 = 42.65 \text{ ms is } 0.04265 \text{ seconds}$
 Transfer function = $1 / 0.001819 \text{ s}^2 + 0.0853 + 1$

Figure 1 shows the process reaction curve from the PID data provided. 73% of this curve is then found and a value of 112.6 for x was found.

Figure 2 shows the value for x being 42.65 which is calculated above using the original value of 112.6 for 73%.

From this a value of x is 0.1926 seconds is found.

Following the Caldwell method stated in the research a value of 0.5 is found for $t2/t1 + t2$.

Values of $t1$ and $t2$ are 42.65 ms and therefore 0.04265 is the fractional response times.

This then creates the transfer function $\text{Transfer function} = 1 / 0.001819 \text{ s}^2 + 0.0853 + 1$ which can be used in Simulink to simulate the next part of the assignment. *missed an 's' here*

3.2 Simulation Using Simulink

developed

Simulation results for PID controller below using Simulink model discovered above.

*You have not explained the LUT
or the transport delay in this model*

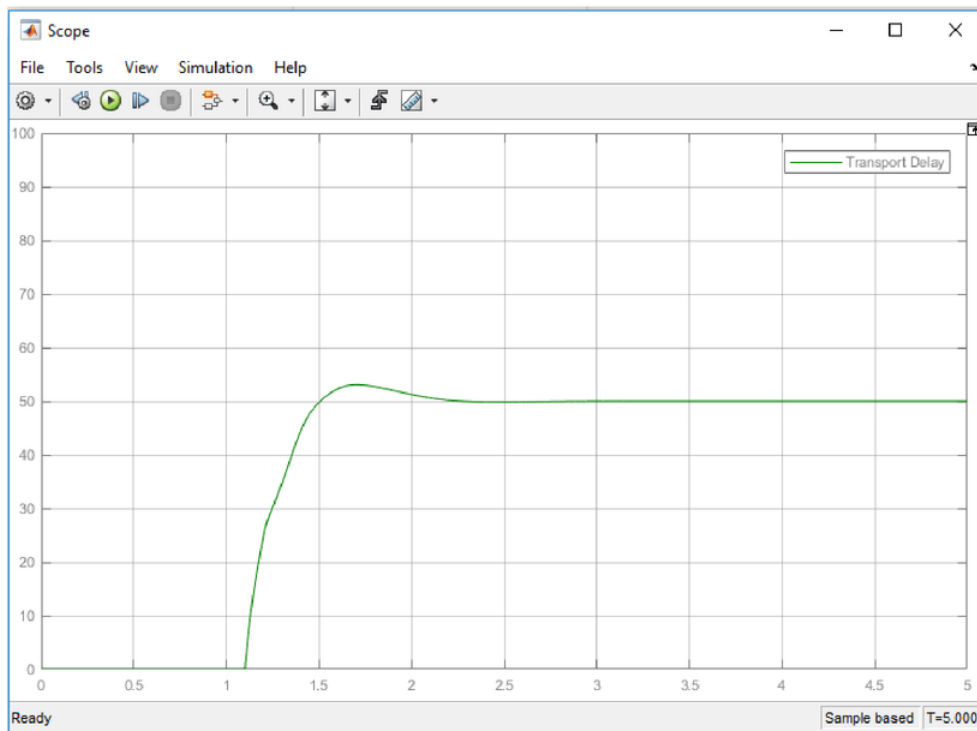
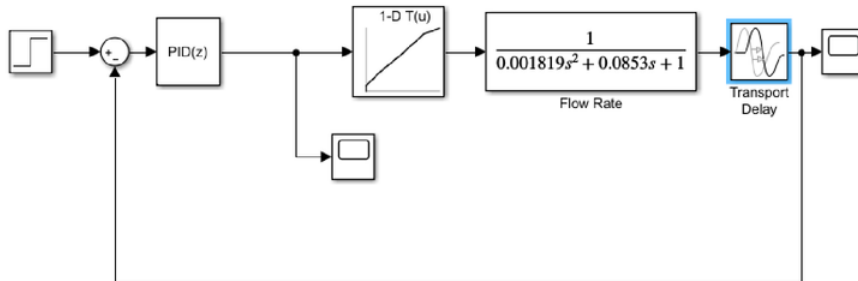


Figure 10 - Simulation Graph (1)

This is incorrect

Figure 10 shows that using the Ziegler-Nichols method the graph using the transfer function above was produced. This is already quite good as a process reaction curve

but by adjusting the values can be made better as this curve has overshoot and a response time which can be improved upon.

Block Parameters: PID Controller

This block implements continuous- and discrete-time PID control algorithms and includes advanced features such as anti-windup, external reset, and signal tracking. You can tune the PID gains automatically using the 'Tune...' button (requires Simulink Control Design).

Controller: **PID** Form: **Parallel**

Time domain:
☐ Continuous-time
☒ Discrete-time

Discrete-time settings
 Integrator method: **Forward Euler**
 Sample time (-1 for inherited): **0.001**

Main | **PID Advanced** | Data Types | State Attributes

Controller parameters

Source: **internal** [Compensator formula](#)

Proportional (P): **0.23**

Integral (I): **3.72989611975612**

Derivative (D): **0.03**
☐ Use filtered derivative

Filter coefficient (N): **1215.13600801088**

Select Tuning Method: **Transfer Function Based (PID Tuner App)** **Tune...**

Initial conditions

Source: **internal**

Integrator: **0**

Differentiator: **0**

External reset: **none**

☐ Ignore reset when linearizing
☒ Enable zero-crossing detection

OK **Cancel** **Help** **Apply**

Figure 11 - Simulation Values (1)

The values in figure 11 show:

P = 0.23

I = 3.73

D = 0.03

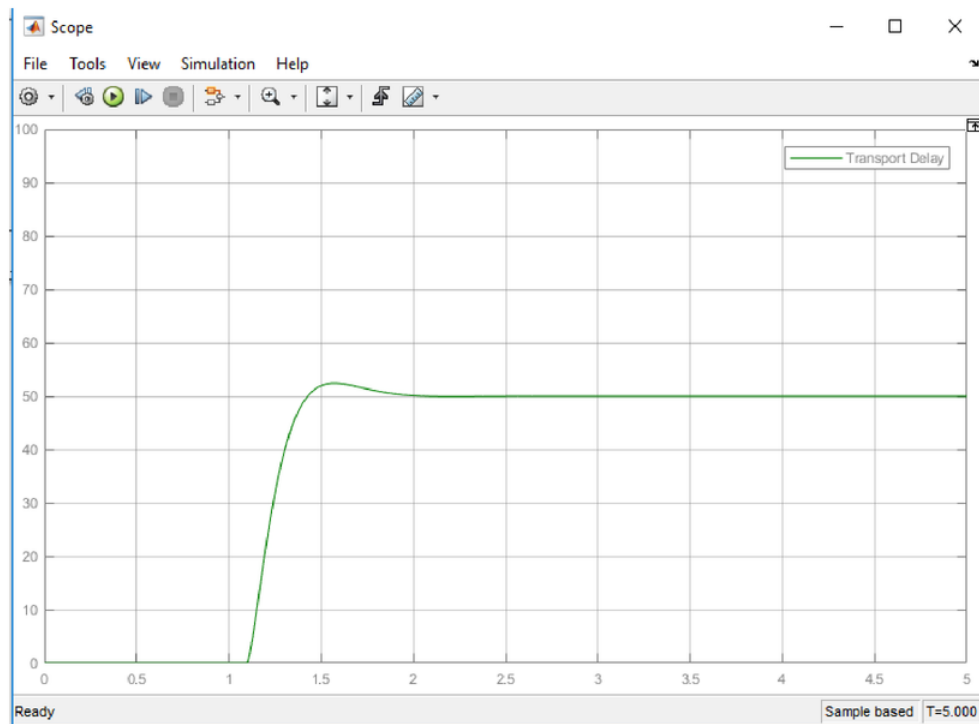


Figure 12 - Simulation Graph (2)

Figure 12 shows that using the Ziegler-Nichols method ^{[You are not using the Ziegler-Nichols method here](#)} the graph using the transfer function above was produced. This is improving on the process reaction curve above but by adjusting the values can be made better as this curve still has overshoot and a response time which can be improved upon. (Although better than figure 10)

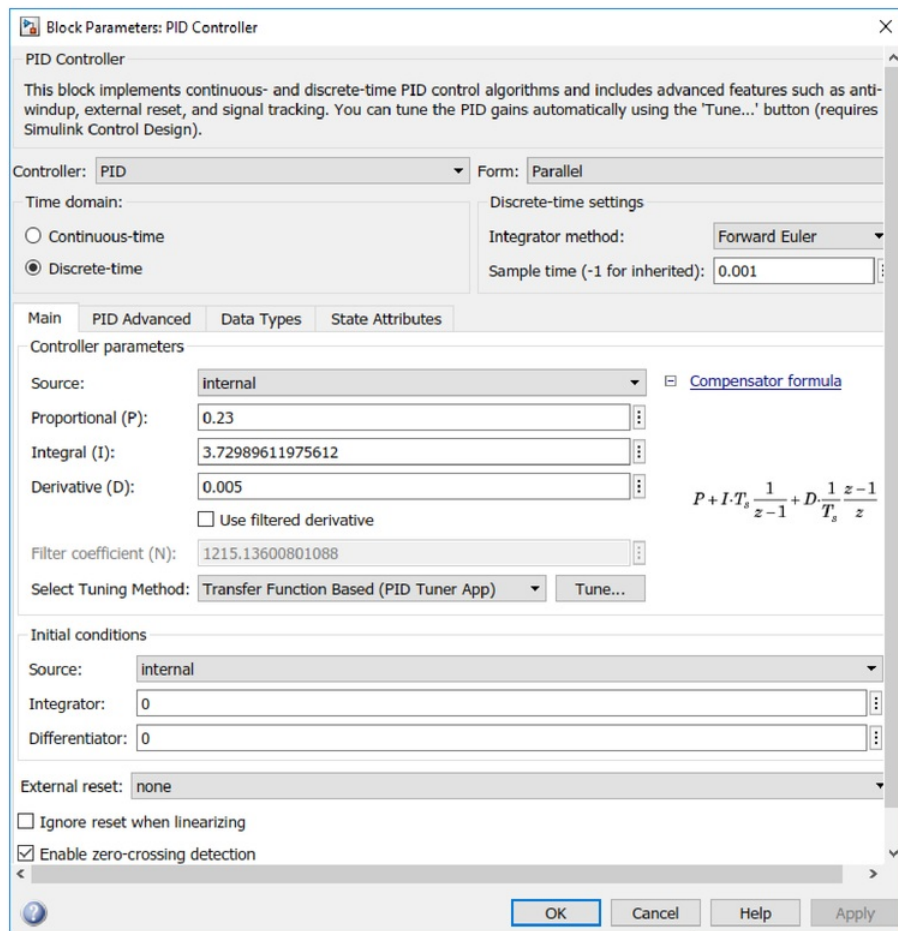


Figure 13 - Simulation Values (2)

The values in figure 13 show:

P = 0.23

I = 3.73

D = 0.005

By decreasing D the curve has improved.

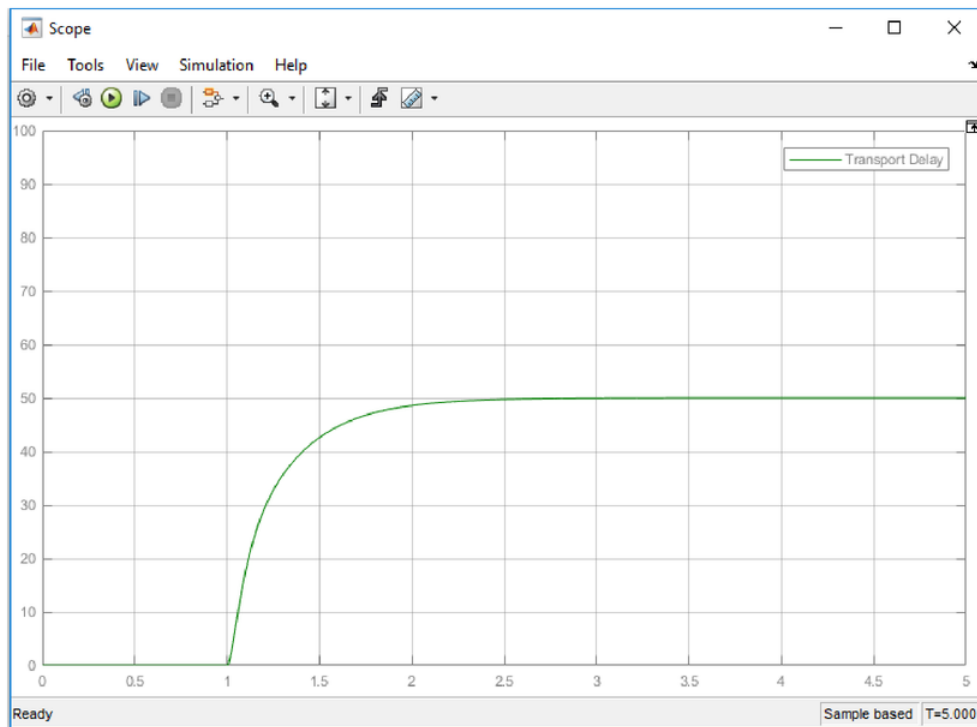


Figure 14 - Simulation Graph (3)

Figure 14 shows that using the Ziegler-Nichols method the graph using the transfer function above was produced. This has improved on both the process reaction curves above by adjusting the values further. There is now no overshoot and the response time is as low as it has been before in the other graphs.

Block Parameters: PID Controller

This block implements continuous- and discrete-time PID control algorithms and includes advanced features such as anti-windup, external reset, and signal tracking. You can tune the PID gains automatically using the 'Tune...' button (requires Simulink Control Design).

Controller: **PID** Form: **Parallel**

Time domain:
☐ Continuous-time
☒ Discrete-time

Discrete-time settings
 Integrator method: **Forward Euler**
 Sample time (-1 for inherited): **0.001**

Main | **PID Advanced** | Data Types | State Attributes

Controller parameters

Source: **internal** [Compensator formula](#)

Proportional (P): **0.23**

Integral (I): **3.1**

Derivative (D): **0.005**

☐ Use filtered derivative

Filter coefficient (N): **1215.13600801088**

Select Tuning Method: **Transfer Function Based (PID Tuner App)** **Tune...**

Initial conditions

Source: **internal**

Integrator: **0**

Differentiator: **0**

External reset: **none**

☐ Ignore reset when linearizing

☒ Enable zero-crossing detection

OK **Cancel** **Help** **Apply**

Figure 15 - Simulation Values (3)

Figure 15 shows the values as:

P = 0.23

I = 3.1

D = 0.005

By decreasing the value for I slightly the overshoot has been erased and the response time has gotten lower.

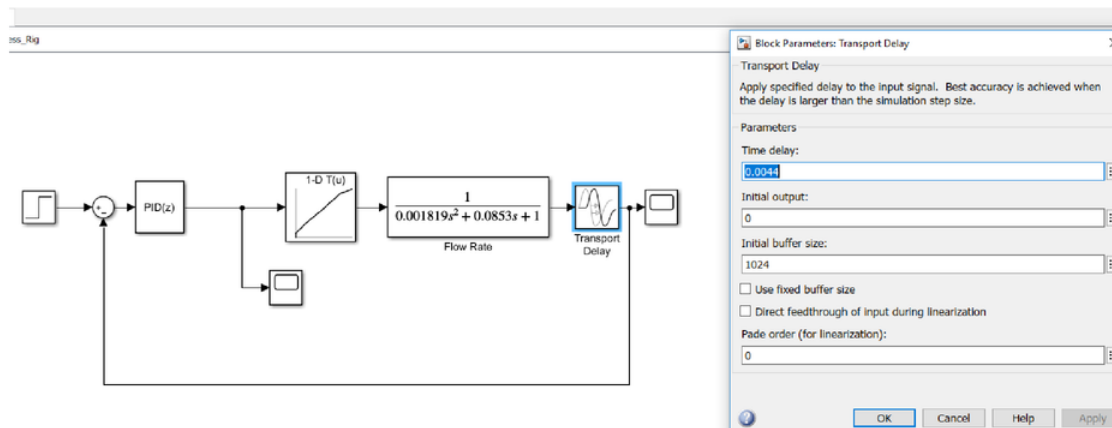


Figure 16 - Simulation Time Delay

Figure 16 shows the time delay (highlighted) to be 0.0044 seconds which is the same as the experiment time delay shown in the next task.

This is good but it belongs earlier in the development of the model.

This is a non-sense title, simulation and practical and 2 different things

3.3 Practical Simulation Results

Did you mean td?

Using the value for K_d , the same as above a practical simulation can be made. This uses the same time delay as the simulated method which show shown in Figure 18.

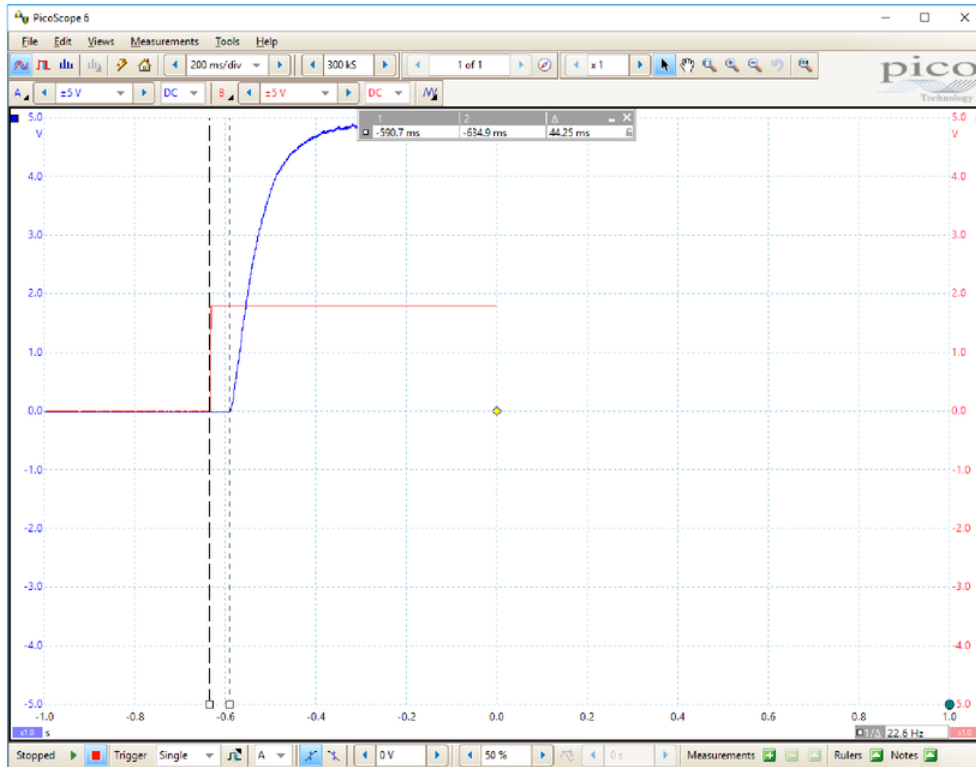


Figure 17 - Practical Testing (1)

Figure 17 shows the flow meter being switched on and its reaction time and lag. This then counts the flow until it reaches it set point of 100 from 0-5V and is then stopped; this creates the process reaction curve and links which the research discussed above.

1	2	Δ	-	X
-590.7 ms	-634.9 ms	44.25 ms		

Figure 18 – Time Delay of 44.2 ms

Values of:

KP 0.23

KI 3.1

KD 0.005

Are then entered onto the Bytronic rig PLC screen as seen in figure 6 and the set point set to 50. (this will be 2.5 V)

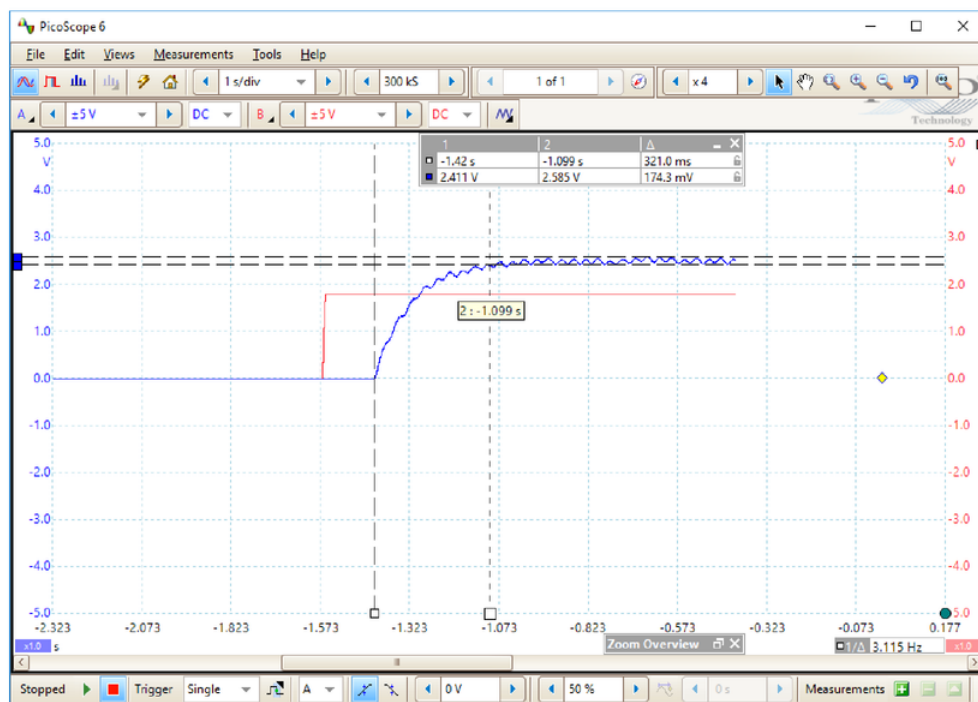


Figure 19 - Process Reaction Curve for Practical Values (1)

Response time = 321 ms, this is the amount of time it takes to reach its set point of 50% and without overshoot. As the practical values were meant to be making the simulated values optimal the values were altered to try and find this.

This could not be done as the values found in the simulation were already found to be perfect and could not be improved, proof of this is below as more results are shown of trying to improve the process reaction curve.

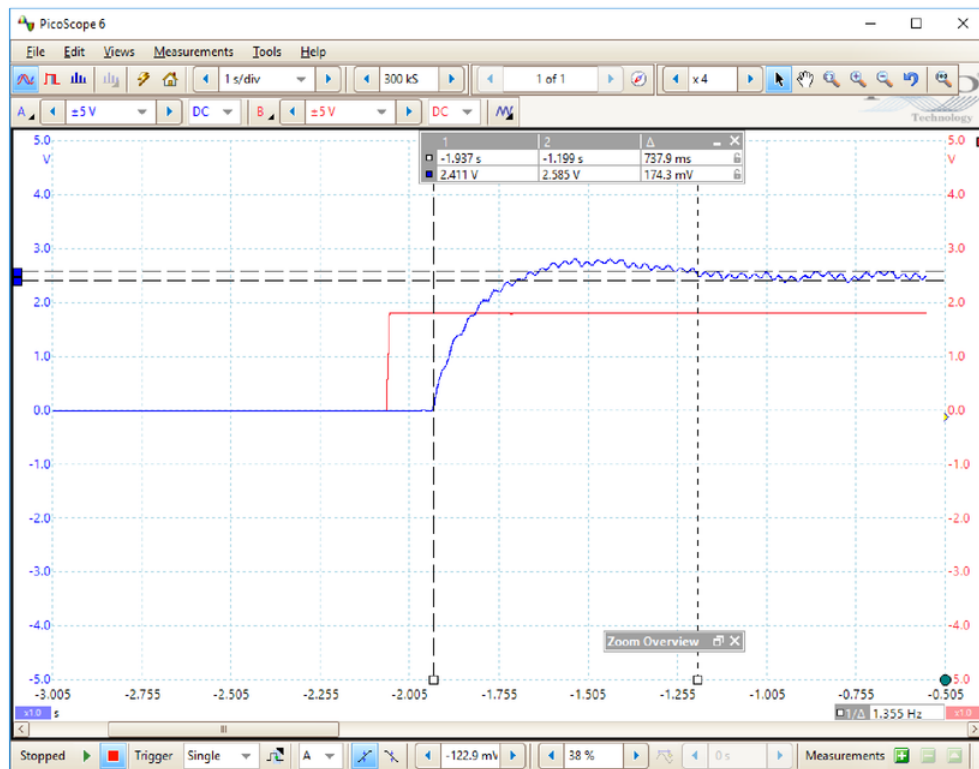


Figure 20 - Process Reaction Curve for Practical Values (2)

737.9 ms response time which is worse as it has a large overshoot and takes time to settle back into the area of the set point.

This is proof that above was already the perfect set of value for K_d , K_i and K_p .

3.4 P, PI and PID Tuning

P controller

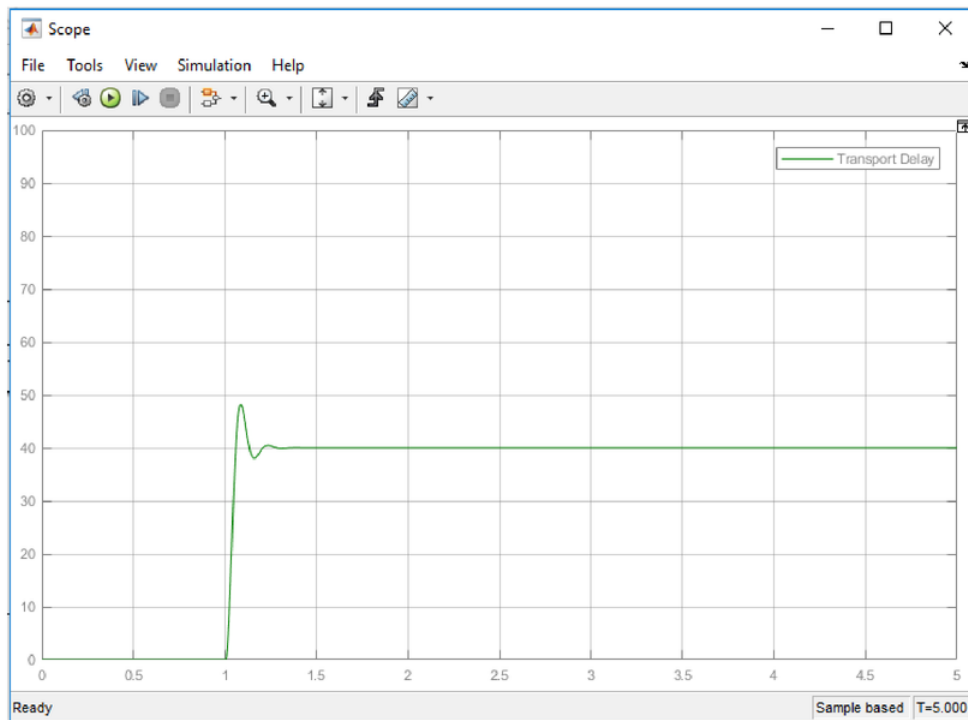


Figure 21 - Tuning P Controller Graph (1)

Figure 21 shows the P controller being tuned to find the optimum value for K_p . It has a lot of overshoot but the response time is ok.

*This is
good
the
belong
s
earlier
in the
simulat
ion part*

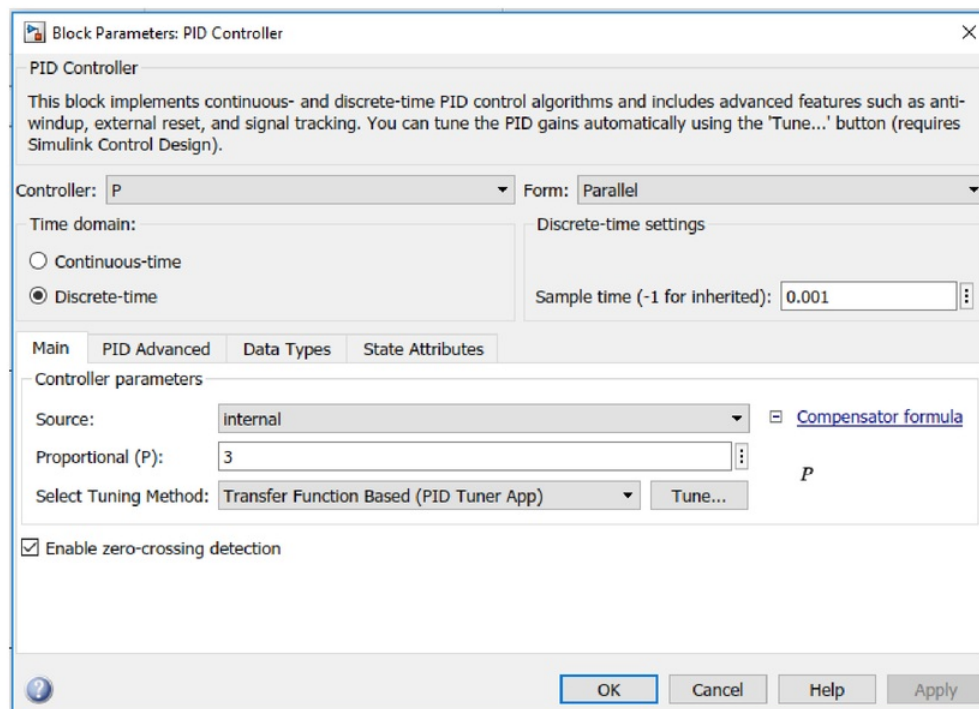


Figure 22 - Tuning P Value (1)

A value of 3 for P is shown above, this will be altered by auto-tuning to find the optimum value.

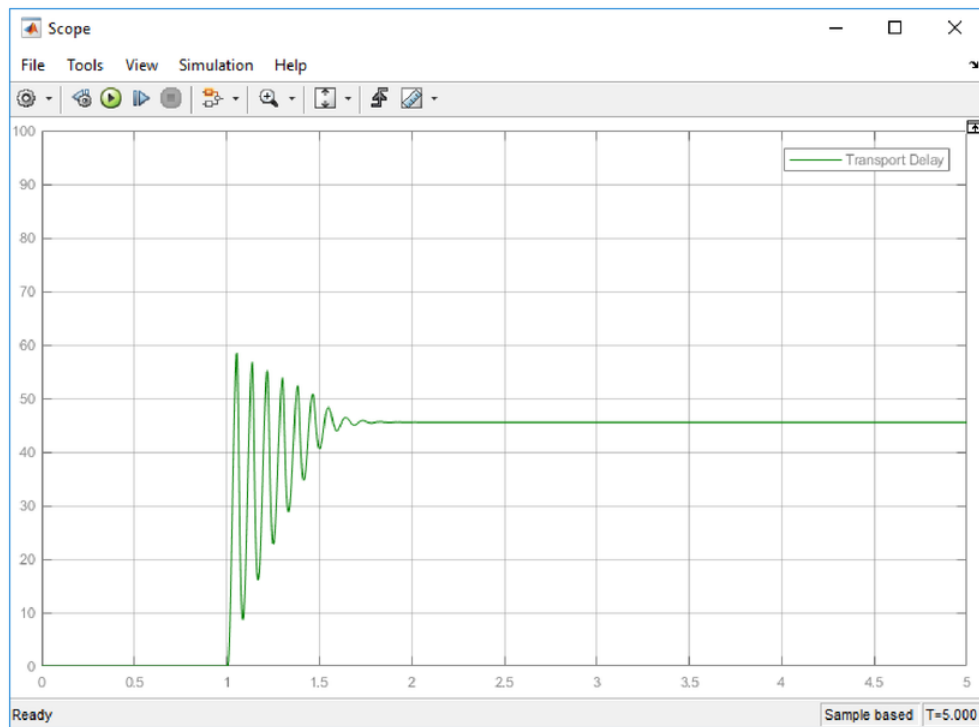


Figure 23 - Tuning P Controller Graph (2)

Figure 23 shows the P controller being tuned to find the optimum value for K_p . It has a lot of overshoot and oscillation but the response time is still the same. This change has made the P controller worse.

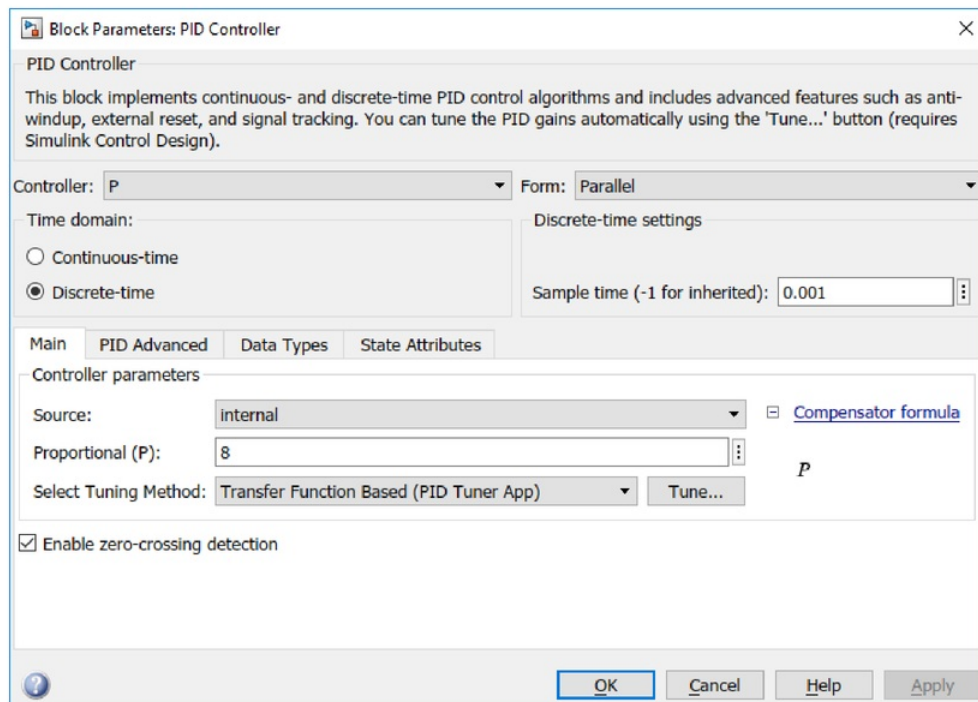


Figure 24 - Tuning P Value (2)

Figure 24 shows the tuning value for P as 8, this has made the process reaction curve worse and therefore a value lower than 3 is needed to make the curve better.

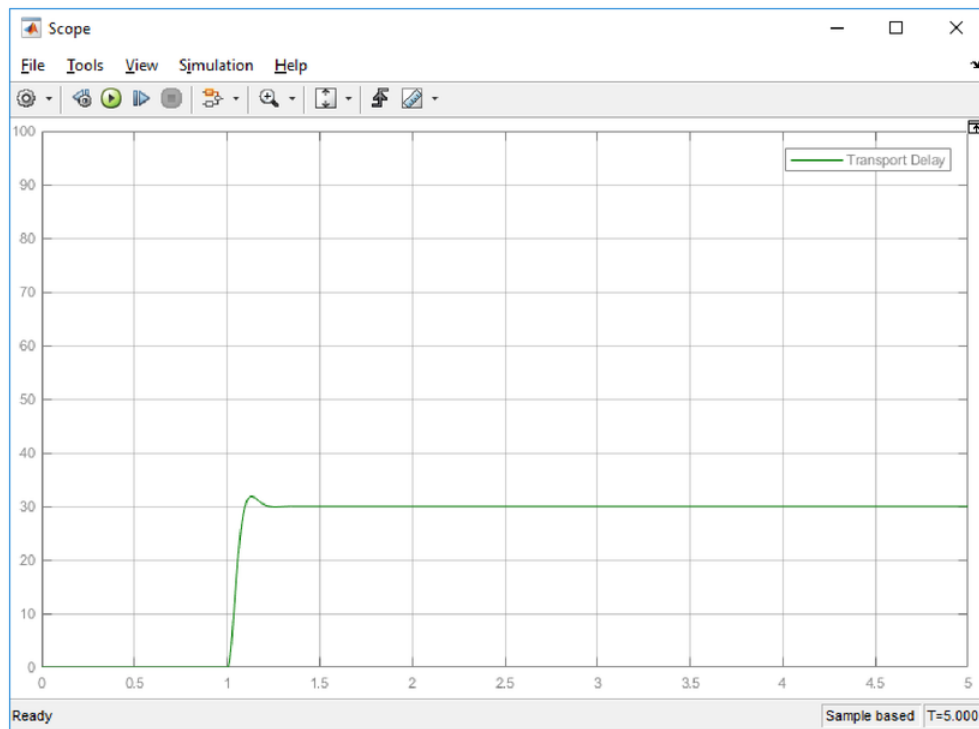


Figure 25 - Tuning P Controller Graph (3)

Figure 23 shows the P controller being tuned to find the optimum value for K_p . It has a minimal overshoot but the response time is still the same. This change has made the P controller better and at its optimal performance.

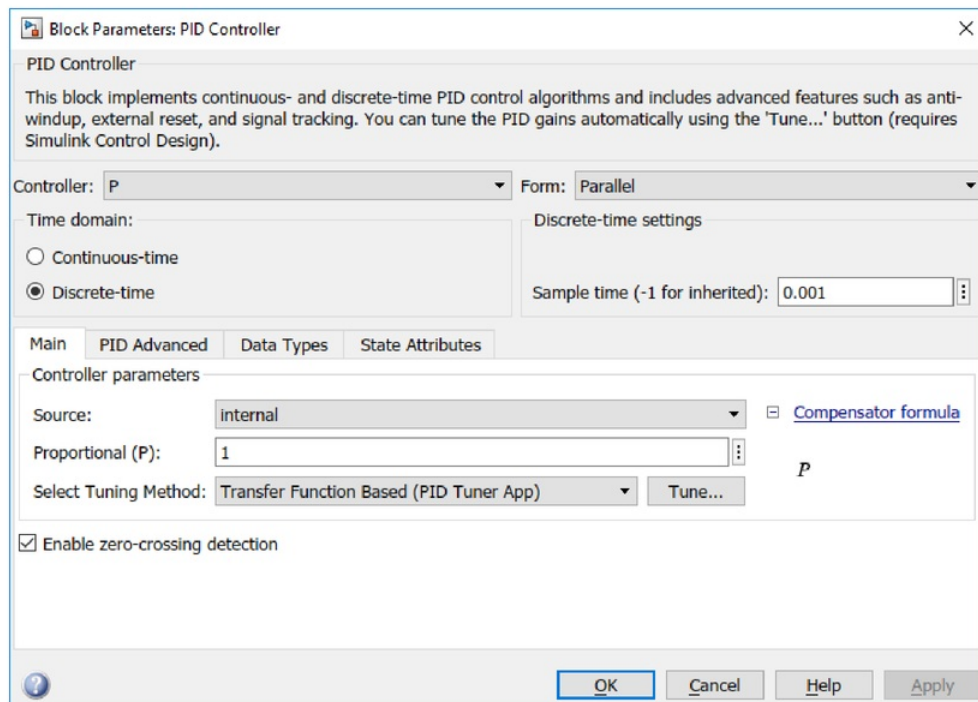


Figure 26 - Tuning P Value (3)

Figure 26 shows the optimum value for P is 1.

PI controller

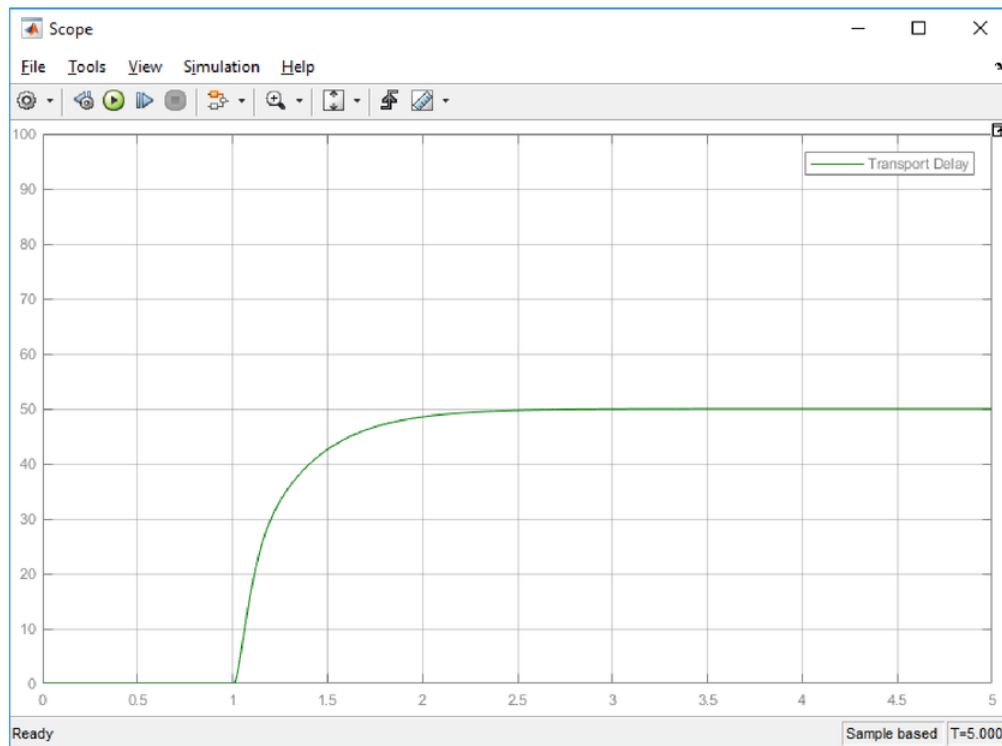


Figure 27 - Tuning PI Controller Graph (1)

Figure 27 shows the PI controller being tuned to find the optimum value for K_p and K_i . It has no overshoot and the time delay is good. The response time could be improved upon though.

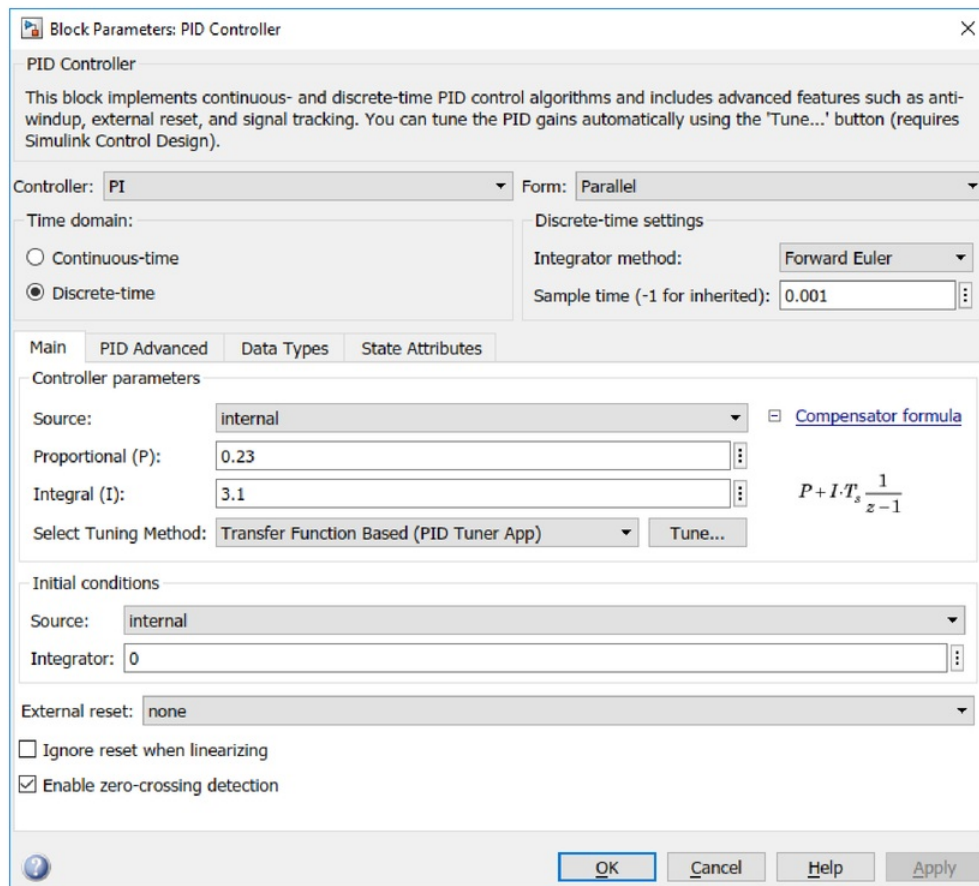


Figure 28 - PI Tuning Value (1)

Figure 28 shows the values:

P = 0.23

I = 3.1

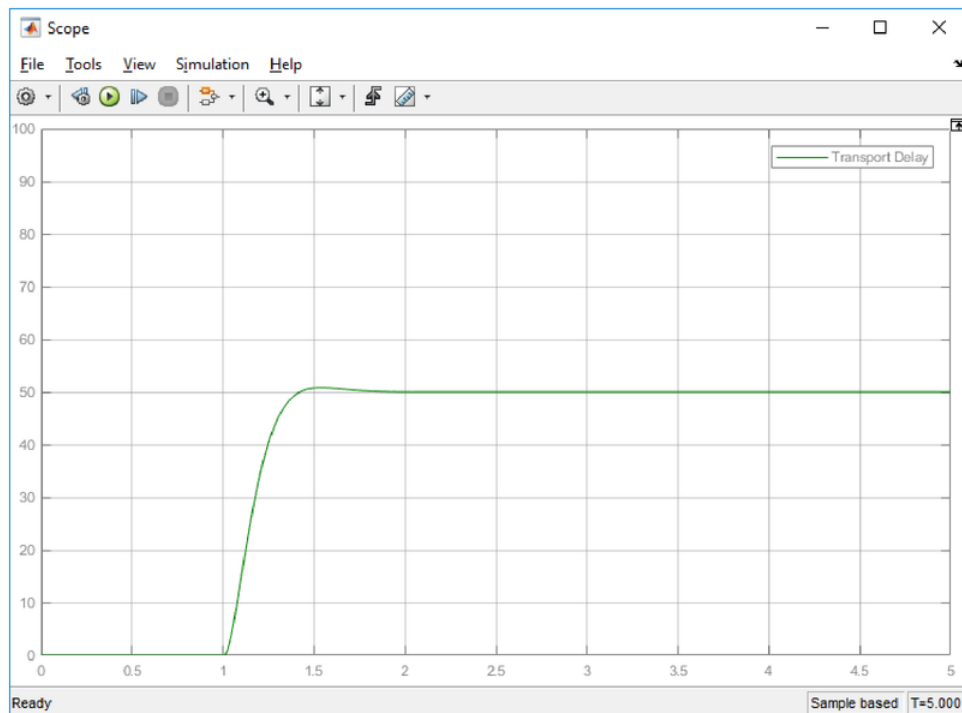


Figure 29 - Tuning PI Controller Graph (2)

Figure 29 shows the PI controller being tuned to find the optimum value for K_p and K_i . It has minimal overshoot and the time delay is good. The response time has been improved in the process reaction curve and therefore the minimal overshoot is acceptable.

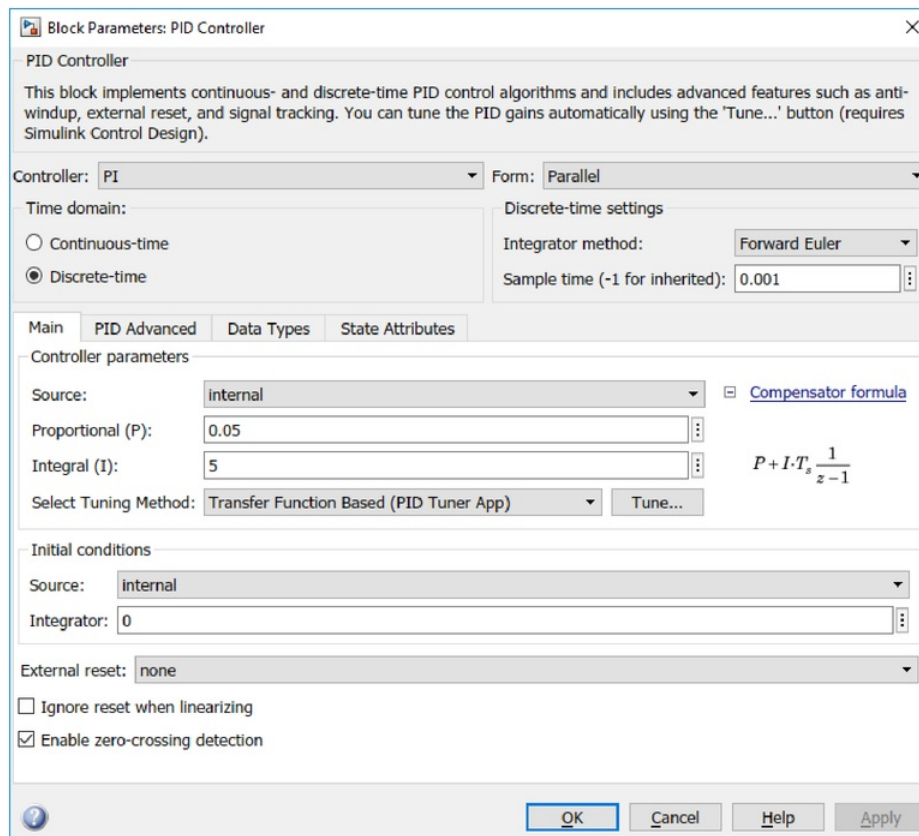


Figure 30 - PI Tuning Value (2)

Figure 30 shows the values:

P = 0.005

I = 5

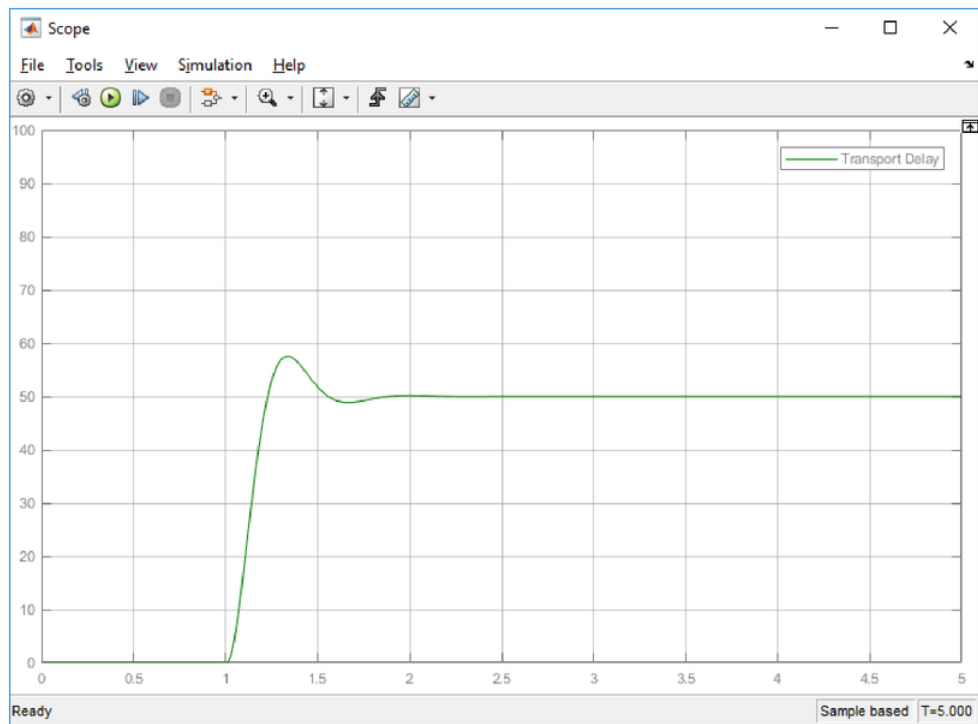


Figure 31 - Tuning PI Controller Graph (3)

Figure 31 shows the PI controller being tuned to find the optimum value for K_p and K_i . It has more overshoot and the time delay is good. The response time has been improved in the process reaction curve but not by much and the overshoot is worse so therefore the process reaction curve and values in figures 29 and 30 are the best.

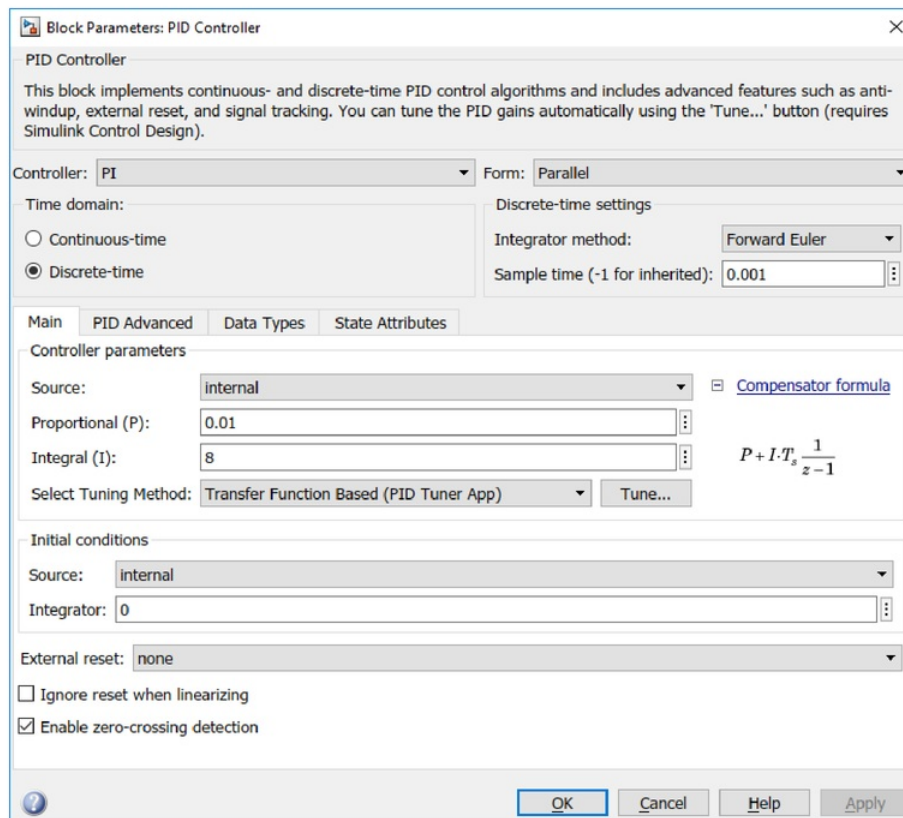


Figure 32 - PI Tuning Value (3)

Figure 32 shows the values:

$P = 0.01$

$I = 8$

The tuning for PID is already complete in 3.2, therefore this will not need to be done again here.

By decreasing I, the response time is improved and by decreasing D the overshoot is improved. (for PID tuning)

Reducing P in its own tuning will make the system better.

3.4 Ziegler-Nichols Method of Simulation

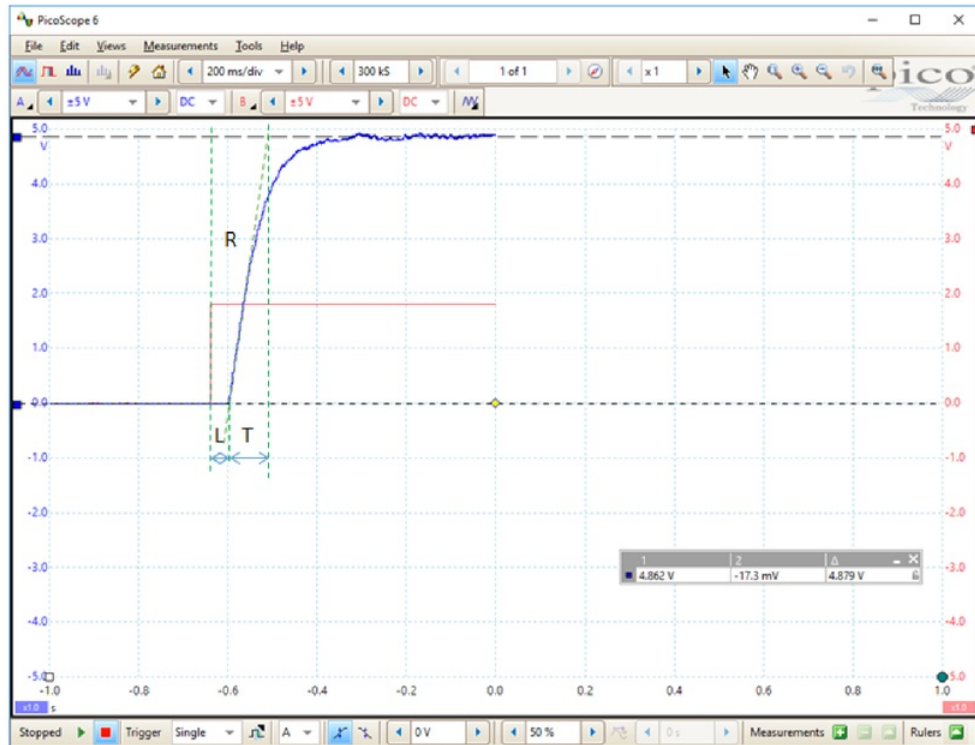


Figure 33 - Ziegler-Nichols Method

Figure 33 shows the time taken for the time delay and response time for 100% set point of the Bytronic rig. Values can then be taken for T, L and R.

$T = 0.09 \text{ S}$ (time delay)

$L = 0.04 \text{ S}$ (lag time)

$R = 100/0.09 = 1111.11$ (reaction rate)

Control Mode	Kp	Ki	Kd
P	$100/(1111.11*0.04) = 2.25$		
PI	$0.9*100/(1111.11*0.04) = 2.025$	$2.025/(3.33*0.04) = 15.2027$	
PID	$1.2*100/(1111.11*0.04) = 2.7$	$2.7/(2*0.04) = 33.75$	$0.5*2.7*0.04 = 0.054$

Figure 34 - Ziegler-Nichols Calculated Value Results

The results show that the system lag messing up the Ziegler Nichols method of tuning, this is creating a much bigger value for each Kp, Ki and Kd than the simulated and practical results.

Therefore the Caldwell model method is better than Ziegler Nichols.

You should have tried these values in the program and shown evidence to back up your statement.

4. Conclusions and Recommendations

To be able to conclude the aims and objectives must be used to see if the assignment was a success.

These were as follows:

- To be able to develop a mathematical model of a second-order dynamic system using a transfer function from a process reaction curve.

This has been successful as a transfer function and model were produced and simulated and tested practically.

- To be able to use a simulation package and process control system to examine the response of the system to a step input test signal.

This was successful using Simulink and the Bytronic rig to gain results.

- Research into the characteristics of a range of flow transducers incorporated into an instrumentation system.

This was successfully completed in the research section of the assignment.

- Process reaction curve method of tuning a PID controller.

This was successfully done within parts of the assignment (3.2).

Overall the assignment is a success as all aims and objectives were met and completed.

In conclusion the Caldwell method was found to be the better method of tuning a control loop system over the Ziegler-Nichols method.

This is true but you did not provide the evidence through testing to prove it.

What else did you learn?

What are your recommendations

5. Bibliography and Appendix

Bibliography

- differential-pressure-flow-meters-dp-flow-meters/* (n.d.). Retrieved Feb 2018, from <http://www.flowmeters.co.uk>: <http://www.flowmeters.co.uk/differential-pressure-flow-meters-dp-flow-meters/>
- differential-pressure-technology*. (n.d.). Retrieved from <http://www.flowmeters.com>: <http://www.flowmeters.com/differential-pressure-technology>
- engineeringtoolbox. (n.d.). *orifice-nozzle-venturi-d_590.html*. Retrieved from <https://www.engineeringtoolbox.com>: https://www.engineeringtoolbox.com/orifice-nozzle-venturi-d_590.html
- Globalspec. (n.d.). *learnmore/sensors_transducers_detectors/flow_sensing/turbine_flow_meters*. Retrieved Feb 2018, from <https://www.globalspec.com>: https://www.globalspec.com/learnmore/sensors_transducers_detectors/flow_sensing/turbine_flow_meters
- Msubbu. (n.d.). *http://fm/Unit-III/PitotTube.htm*. Retrieved Feb 2018, from <http://www.msubbu.in>: <http://www.msubbu.in/fm/Unit-III/PitotTube.htm>
- Praveen; Advantages and Disadvantages of Orifice Meter and Venturi Meter. (2018). *document/362713943/Advantages-and-Disadvantages-of-Orifice-Meter-and-Venturi-Meter*. Retrieved Feb 2018, from <https://www.scribd.com>: <https://www.scribd.com/document/362713943/Advantages-and-Disadvantages-of-Orifice-Meter-and-Venturi-Meter>

This is not the correct Harvard way of listing references. You must remember to select the Harvard option within MS Word's reference ribbon.

Assignment 1 Josh Beer

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

62/100

PAGE 1

Text Comment. word count?

PAGE 2

Text Comment. ?????

PAGE 3

PAGE 4

PAGE 5

Text Comment. spelling

PAGE 6

PAGE 7

PAGE 8

Text Comment. how would this difference in level be sensed by the control system?

PAGE 9

Text Comment. spelling

PAGE 10

PAGE 11

Text Comment. This is incorrect. The pulses are fed into an F to V chip which converts them into an analogue signal 0 to 5Vdc before going to the PLC.

PAGE 12

Text Comment. Incorrect, you must also divide by 1.32

Text Comment. Where is the Caldwell graph?

Text Comment. This is incorrect, you are describing the ultimate cycle method not the process reaction method, hence you are referring to the critical gain which does not relate to the method used in this assignment.

Text Comment. If you had described the correct method, you would have been able to explain the meaning of the terms R, L and delta c.

PAGE 13

PAGE 14

Text Comment. This is incorrect as you have left out the 1.32 factor ($112.6/2 = 56.3$) yet you have produced the correct result of 85.3 ms ??????????????????

Text Comment. brackets are needed here $(t_1 + t_2)/2$

Text Comment. brackets are needed here also.

Text Comment. No explanation given as to where the 0.5 comes from?

Text Comment. With no Caldwell graph presented, it is impossible to see how you arrived at this value

Text Comment. missed an 's' here

PAGE 15

Text Comment. developed

Text Comment. You have not explained the LUT or the transport delay in this model

Text Comment. This is incorrect

PAGE 16

PAGE 17

Text Comment. You are not using the Ziegler Nichols method here

PAGE 18

PAGE 19

PAGE 20

Text Comment. Where are your results for the P and PI controllers?

PAGE 21

Text Comment. This is good but it belongs earlier in the development of the model.

PAGE 22

Text Comment. This is a non-sense title, simulation and practical and 2 different things.

Text Comment. Did you mean td?

PAGE 23

PAGE 24

PAGE 25

Text Comment. This is good but belongs earlier in the simulation part

PAGE 26

PAGE 27

PAGE 28

PAGE 29

PAGE 30

PAGE 31

PAGE 32

PAGE 33

PAGE 34

PAGE 35

PAGE 36

PAGE 37

Text Comment. This is practical tuning not simulation

PAGE 38

Text Comment. You should have tried these values in the program and shown evidence to back up your statement.

Text Comment. This is mostly self congratulatory. You must explain what you have learnt through the assignment, what can you now say? Make statements about facts.

Text Comment. This is true but you did not provide the evidence through testing to prove it.

Text Comment. What else did you learn?

Text Comment. What are your recommendations

Text Comment. This is not the correct Harvard way of listing sources. You must remember to select the Harvard option within MS Word's reference ribbon.

GRADING FORM: CSG-RUBIC

JOSHUA BEER

62

RESEARCH-INFORMED LITERATURE



Section 1: Your research - Evidence of background reading and research contained in the report. However, not all information present is correct (Ziegler-Nichols). (12/20) Section 4: Your use of Harvard for citing and listing - Good range of sources and use of Harvard for citing but the listing method is not correct. You must remember to switch on the Harvard option within MS Word.. (3/5)

15

KNOWLEDGE AND UNDERSTANDING

Section 2: Explanation of the control system and



model - Satisfactory explanation given though you have not explained the LUT. However, since the Caldwell graph is missing and one error exists, your explanation is incomplete. (8/15)

8

ANALYSIS



Sections 2 and 5: Analysis of model, simulation and practical testing - No mathematical analysis of the model offered. Simulation is good as is practical testing except for the Ziegler-Nichols method which has not been implemented. (10/20) Section 3: Conclusions and recommendations - This is mostly self congratulatory. You must explain what you have learnt through the assignment, what can you now say? One helpful statement made about tuning methods but cannot be backup up since there is little evidence to support it. (4/10)

14

PRACTICAL APPLICATION AND DEP.



Sections 2: Development of the model, use of Simulink – Well developed with good use of Simulink. (8/10) Sections 2: Practical tuning – Good evidence for the model method but the Ziegler Nichols method has not been implemented. (4/5) Section 2: Presentation of results - Good. (5/5)

17

SKILLS FOR PROFESSIONAL PRAC.



All sections - Well presented, structured and written. (8/10)

8