



UPPSALA UNIVERSITET

Report for 1DT059

Nusrat Hossain

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1 Problem 1 Controlling Sequence of Tanks

1.1 a

levels of water evolve over time :

For tank1,
 $A \cdot dh_1/dt = \text{Inflow1} - \text{Outflow1}$
Here $\text{Outflow1} = 0.1 \cdot h_1$,
So, $A \cdot dh_1/dt = \text{Inflow1} - 0.1 \cdot h_1$

For Tank2,
 $A \cdot dh_2/dt = 0.1 \cdot h_1 - 0.1 \cdot h_2$
Here A= Area of tank

1.2 b

Please check ex1_b file

1.3 c

Here a Pid controller is designed which getting the input from tank2 .Error calculation is done as the purpose of the Controller is to maintain a constant water level of around 1m in Tank2. Through trial and error the value of KP,KI and KD have been achieved.The Saturation block produces an output signal that is the value of the input signal bounded to the upper and lower saturation values. As the inflow1 is non negative that's why this is done

1.3.1 Empty Tank

When the tanks are empty it means both of the integrator is in initial condition 0.

1.3.2 Full Tank

When the tanks are full it means both of the integrator is in initial condition 2 as it was given water level cannot cross 2 m. So here in the output it is seen that the inflow will start after sometime.

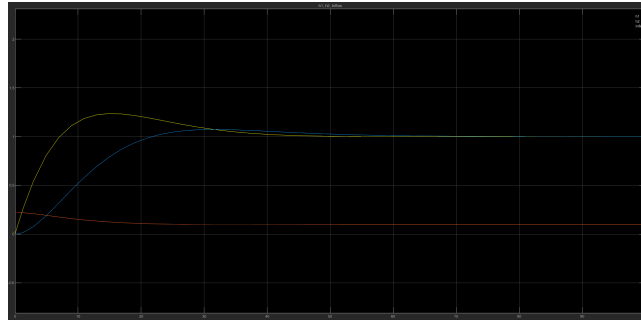


Figure 1: Output with controller and empty tank.

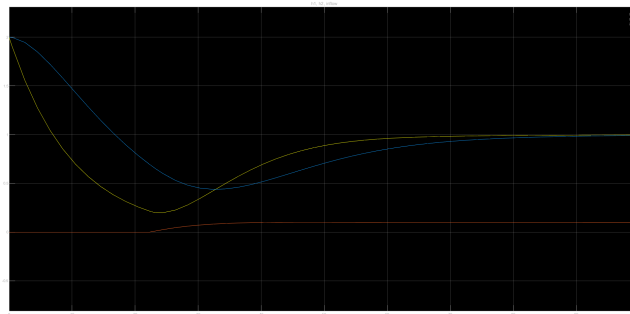


Figure 2: Output with controller and Full tank.

2 Problem 2 Pendulum

2.1 a

Please check ex2_a, ex2a_linearized file

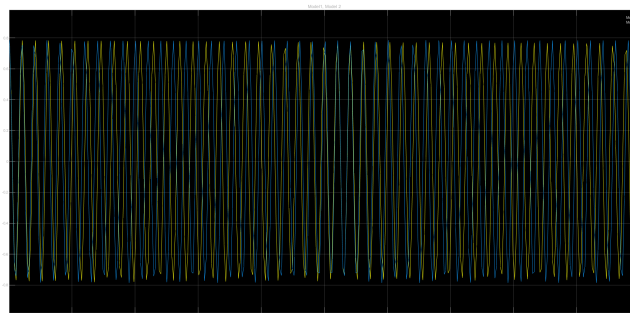


Figure 3: Output of Both Model.

2.1.1

In linearized model we approximate $\sin(\theta)$ by θ

2.2 b

In this model we created counter inside two enabled subsystem which compare the number of periods. This two subsystem are connected to enabled subsystems that takes the counter and divides it by the clock, So the system should enabled at the same time as counter. Now this are connected to a subsystem which calculates the percentage difference and shows the data in one Display module. Here Percentage difference is 3.516 (approximate).

2.3 c

The Maxium starting angle is 22.6546degree (Approximate). Here in matlab script all the model parameters are defined first. Please run the matlabscrip first to check it.

References

- [1] Counter design, retrieved from:
<https://stackoverflow.com/questions/35319945/how-to-create-a-counter-in-simulink>
- [2] Frequency calculation,Idea
<https://se.mathworks.com/matlabcentral/answers/102593-how-can-i-determine-the-frequency>
- [3] Simulink interaction with matlab script, retrieved from:
<https://www.youtube.com/watch?v=sF_sjFqNFUkab_channelChristopherLum>