EL2450 Homework 1

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Q 1: A gain named Tap exists in the Tank 1 model, what is its function?

A: The gain Tap models the openable tap on the upper tank. The value 0 means that it is currently closed. A value of 1 means fully opened.

Q 2: Place the poles to give a following step resonse:

- **Rise time less than 6s**
- **Overshoot less than 35%**
- **Settling-time less than 30s**

A: With the parameters set to $\chi = 0.5$, $\omega_0 = 0.2$ and $\xi = 0.7$ yields a system with risetime of 3.31 s and a settling time 18.8 s and an overshoot of 22.6%.

Q 3: What does the reference signal look like?

A: The signal starts at 40 and recieves a step by 10 at 100 s which sets it to 50.

Q 4: Use the parameter generator to get values.

A: Done.

Q 5: Use the parameters to get different responses. WHich is best?

A: The parameters are:

Table 1: Parameter values and performance.

χ	ζ	ω_0	T_r	M	T_s
0.5	0.7	0.1	6.38	6.67	38.1
0.5	0.7	0.2	3.31	22.6	18.8
0.5	0.8	0.2	3.19	20.9	18.4

The last parameter configuration works best. It is the fastest though it has quite significant overshoot, which is still within the given tolerance.

Q 6: What is the cutoff frequency for the open loop system? How was this derived?

A: The open loop system $G_o = F \cdot G$ and the cutoff frequency is the frequency when the amplitude gain is 0 dB. Using the bode plots this frequency is found to be $\omega_c = 0.343$rad/s. This is confirmed by the MatLab command *allmargin(Go)*.