Automatic Control – EEE 2002 Tutorial Exercise VIII

1. Find the step response of the OLTF: $G(s)=\frac{1}{(s+1)(s+2)(s+3)}$.
2. Find the CL step response by assuming a proportional controller, K_p=1.
3. Analytically prove that by increasing K_p we cannot make the steady state error zero.
4. Crosscheck your previous answer numerically.
5. For K_p=10, find the steady state error numerically.
6. Replace the P controller with a PI controller. Find analytically the steady state error.
7. For K_i=2 and 6 crosscheck your previous answer.
8. What is it going to be the response of the system if we increase K_p from 10 to 20 and K_i from 6 to 10?
9. For these last values of K_p, K_i find the de/dt.
10. Add a D part in your controller and find analytically the steady state error.
11. For K_d=5 and 10 crosscheck your previous answer.
12. Increase the P gain from 20 to 50 and study the response of the system.
13. For this last value check the response of $K_p \times error$, $\frac{K_I}{s} \times error$ and $K_d s \times error$.
14. Find the appropriate K_p, K_i, K_d for $G(s)=\frac{1}{(s+1)(s+2)(s+3)}$ by using the Ziegler Nichols II method.
15. Find the appropriate K_p, K_i, K_d for $G(s)=\frac{1}{s^2+6s+16}$ such as the closed loop system has $\omega_n = 6 rad/s$, $\zeta = 0.5$ and real pole at a=-5.