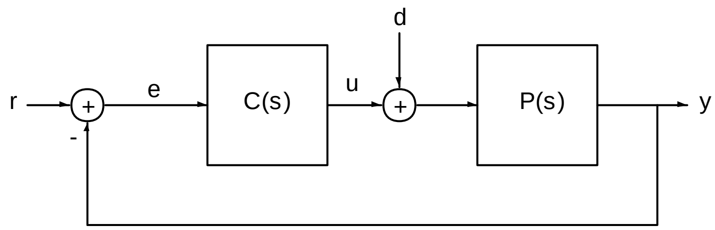
EEE 304 HW 5

Problem 1:
For the feedback system shown below, compute the transfer functions e/r, u/d, y/d, e/d.



Problem 2: (Low Bandwidth Controller)
For the feedback system of Problem 1, suppose $P(s) = 1/(s+0.5)$.

a. When $C(s) = K$, design K so that the loop crossover frequency (i.e., w: |P(jw)C(jw) |= 1) is 0.2rad/s. What is the contribution of a constant unit disturbance to the output?
b. When $C(s) = K(Ts+1)/s$, design K,T so that the crossover frequency is 0.2rad/s and the phase margin (i.e., the difference between the loop angle and –180 at the crossover frequency, $\angle P(jw_c)C(jw_c)+180$) is at least 60^o. What is the contribution of a constant unit disturbance to the output?

Verify in MATLAB, using **step(feedback(P,0.54),feedback(P,C))**

Problem 3: (High Bandwidth Controller)
For the feedback system of Problem 1, suppose $P(s) = 1/(s+0.5)$.

a. When $C(s) = K$, design K so that the loop crossover frequency (i.e., w: |P(jw)C(jw) |= 1) is 20rad/s. What is the contribution of a constant unit disturbance to the output?
b. When $C(s) = K(Ts+1)/s$, design K,T so that the crossover frequency is 20rad/s and the phase margin (i.e., the difference between the loop angle and –180 at the crossover frequency, $\angle P(jw_c)C(jw_c)+180$) is at least 60^o. What is the contribution of a constant unit disturbance to the output?

Verify in MATLAB, using **step(feedback(P,20),feedback(P,C))**

Problem 4: (Optional, 10% bonus)
Select a suitable sampling rate and use your favorite continuous-to-discrete conversion method to discretize the controllers of P.2 and P.3 (obtain discrete-time "equivalents"). Simulate the responses in SIMULINK (discrete-time controller, continuous time system).