

Department of Electrical and Computer Engineering
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EECE 4130 Problem Set #3

1. Consider the uncontrolled system transfer function

$$G(s) = \frac{1}{s(s+1)(s+2)}$$

The input is $X(s)$ and the output is $Y(s)$.

- Given the feedback gain is $H(s)$ determine the transfer function $Y(s)/X(s)$ for the negative feedback system.
- If the error is defined as $E = X - HY$ determine E/X .
- For $x(t) = tu(t)$ find $H(s)$ such that

$$\lim_{t \rightarrow \infty} e(t) = \frac{1}{10}$$

- Is the closed-loop system is stable.

2. Consider the unity gain negative feedback system. The error $e(t) = x - y$ where x is the input and y is the output. Given the open loop-transfer function

$$G(s) = \frac{s+4}{s(s+5)}$$

- Determine the steady state error for $x = u(t)$
- Determine the steady state error for $x = t^3 u(t)$.

3. Consider the negative gain feedback system having a open-loop gain GH .

- Express the transfer function $Y(s)/X(s)$ in terms of $G(s)$ and $H(s)$.
- If the error is given by $e(t) = x(t) - y(t)$ find $E(s)/X(s)$.
- If $x(t) = tu(t)$ and $G(s) = s/((s+1)(s+2))$ find $H(s)$ such that the steady state error is 0.01.