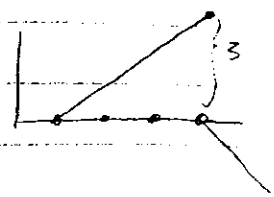
ELEC 360, Midterm, Oct. 04



(4) 1. $y(t) = \begin{cases} (t-1) & 1 \le t \le 4 \\ 0 & \text{else} \end{cases}$

$y(t) = (t-1)u(t-1) - (t-4)u(t-4) - 3u(t-4)$

$Y(s) = \frac{1}{s^2}e^{-s} - \frac{1}{s^2}e^{-4s} - \frac{3}{s}e^{-4s} = \frac{1}{s^2}(e^{-s} - e^{-4s} - 3se^{-4s})$

(5) 2. Paths: $P_1 = \frac{ab}{s^2}$ $P_2 = \frac{bf}{s}$

Loops: $L_1 = \frac{-ak}{s^2}$, $L_2 = \frac{-fk}{s}$, $L_3 = \frac{-d}{s}$

$\Delta = 1 + \frac{ak}{s^2} + \frac{fk}{s} + \frac{d}{s} = (s^2 + (fk+d)s + ak)\frac{1}{s^2}$

$\Delta_1 = 1$ $\Delta_2 = 1$

$G(s) = \frac{P_1 + P_2}{\Delta} = \frac{ab + sbf}{s^2 + (fk+d)s + ak}$

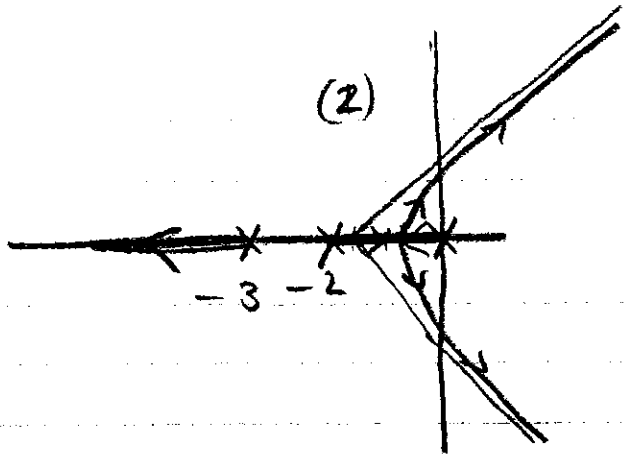
(8) 3. Open-loop $= \frac{K}{s(s+2)(s+3)} = \frac{K}{s^3 + 5s^2 + 6s}$

poles: $0, -2, -3$, asymptotes $\gamma = \pm\frac{180}{3}(2k+1) = \begin{matrix} +60 \\ 180 \end{matrix}$

$\sigma = \frac{-5}{3} = 1.67$ (1) $A'(s) = 3s^2 + 10s + 6 = 0$

$s_{1,2} = \frac{-10 \pm \sqrt{100 - 72}}{6} = \begin{matrix} -2.55 \\ -0.78 \end{matrix}$

(2)



- Initially the system is overdamped and becoming faster
- Critically damped
- Underdamped w/ th increasing K, system slower, more overshoot and eventually becomes unstable.

(4) 4,

$$G_{tot}(s) = \frac{\frac{1}{(s+2)(s+3)}}{1 + \frac{K}{s(s+2)(s+3)}} = \frac{s}{s^3+5s^2+6s+K}$$

s^3+5s^2+6s+K

s^3	1	6	$b_1 = \frac{K-30}{-5}$
s^2	5	K	
s^1	b_1		
s^0	K		

Stable for $K>0$, $K-30<0 \rightarrow K<30$

$0<K<30$