Control Systems

Homework on root locus, December 2^{th} 2010

HW1 Draw the root locus of the following transfer functions, and perform stability analysis using the Routh Criterium:

1. $G(s) = k\frac{1}{s+4}$;
2. $G(s) = k\frac{1}{(s+4)(s+1)}$;
3. $G(s) = k\frac{1}{(s+4)(s+1)(s-4)}$;
4. $G(s) = k\frac{s+2}{s^2(s-4)}$;
5. $G(s) = k\frac{s-1}{s(s+1)(s-4)}$;
6. $G(s) = k\frac{(s^2+1)}{s(s+1)(s-4)}$;
7. $G(s) = k\frac{(s^2+1)}{s^3(s-4)}$.

HW2 For each of the following transfer functions, design a feedback control scheme and a controller $G_c(s)$ such that the closed loop system is asymptotically stable. Moreover, use the Routh Criterium to compute the range of values of the gain of $G_c(s)$ such that the closed loop system is asymptotically stable.

1. $G(s) = \frac{s+1}{s(s-4)}$;
2. $G(s) = \frac{1}{s^2}$;
3. $G(s) = \frac{1}{s(s+5)}$;
4. $G(s) = \frac{1}{s(s-5)}$;
5. $G(s) = \frac{1}{s(s+1)(s-5)}$;
6. $G(s) = \frac{1}{s^2(s+1)(s-5)}$;
7. $G(s) = \frac{(s^2+1)}{s(s-1)(s+5)}$.

HW3 For each transfer function of HW2, design a feedback control scheme and a controller $G_c(s)$ such that the closed loop system is asymptotically stable, and the transient can be considered negligible after $1s$.