

ECE 461/661 - Homework Set #7

Error Constants, Routh Criteria, Sketching a Root Locus - Due Monday, October 17th

1) Determine the system type, the error constants, and the steady-state error for a step input:

G(s)	System Type	K _p	K _v	Steady-state error for a unit step input
$\left(\frac{200}{(s+3)(s+6)}\right)$				
$\left(\frac{2000}{(s+3+j10)(s+3-j10)(s+20)}\right)$				
$\left(\frac{2000}{s(s+3)(s+6)}\right)$				
$\left(\frac{200}{(s-1)(s+5)(s+10)}\right)$				

Use a Routh Table to determine the range of k for stability (the range of k which results in a negative definite polynomial)

2) $(s + 1)(s + 4)(s + 10) + 2k = 0$

3) $(s - 1)(s + 5)(s + 10)(s + 20) + 2k = 0$

Sketch the root locus for the following systems. Include in each

- The real axis loci
- The breakaway point(s)
- The jw crossing(s)
- The gain at the jw crossings, and
- The departure angle for complex poles

4) $G(s) = \left(\frac{2}{(s+1)(s+4)(s+10)}\right)$

5) $G(s) = \left(\frac{2}{(s-1)(s+5)(s+10)(s+20)}\right)$

6) $G(s) = \left(\frac{20(s+1)}{(s+1+j3)(s+1-j3)(s+5)(s+10)}\right)$