EE 475 Quiz 07

Name: key

1. For a unity feedback control system with open loop transfer function $G_o(s)$,
   a. the position error constant Kp= $\lim_{s\to 0} G_o(s)$,
   b. the velocity error constant Kv= $\lim_{s\to 0} s\,G_o(s)$,
   c. the acceleration error constant Ka= $\lim_{s\to 0} s^2 G_o(s)$,
   d. the ess due to a step input is $e_{ss2step}$= $\frac{1}{1+Kp}$,
   e. the ess due to a ramp input is $e_{ss2ramp}$= $\frac{1}{Kv}$,
   f. the ess due to an acceleration input is e_{ss2acc}= $\frac{1}{Ka}$.

   Note: Kv=b0/a1 is not the exact answer, since it cannot calculate Kv for type 0, which is 0, same reason for ka=b0/a2

2. There is a necessary condition before you can use the ess formulas, since they are derived based on the final value theorem. That necessary condition is that All poles on LHP. (left half plane).

3. In the regular case of using the Routh criteria, we can make two statements after the table is constructed. The two statements are:
   a. The characteristic polynomial is stable if 1st column have same sign.
   b. The number of sign changes in the 1st col = number of roots in right half plane.

EE 475 Quiz08

Name:_____

1. Use ζ, σ, ωn , and ωd to fill in the spaces below.

$\omega_d = \omega_n\sqrt{1-\zeta^2}$

- Settling time is inversely proportional to ___σ___ $\Leftarrow t_s = \frac{4}{\sigma}$
- Rise time is inversely proportional to ___ω_n___ $\Leftarrow t_r = \frac{2}{\omega_n}$
- Percentage overshoot is most directly determined by ___ζ___ $\Leftarrow M_p = e^{\frac{-2\zeta}{\sqrt{1-\zeta^2}}}$
- Oscillation frequency is proportional to ___ω_n___
- Peak time is inversely proportional to ___ω_n, ω_d___ $\Leftarrow t_p = \frac{\pi}{\omega_d}$
- Delay time is inversely proportional to ___ω_n___ $\Leftarrow t_d = \frac{1.4}{\omega_n}$

2. The open loop TF of the RL equation has denominator degree n=5 and numerator degree m=2. Answer the following question: $\frac{2}{n-m}$
   i. There are ___5___ branches of root locus.
   ii. There are___3___ asymptotes
   iii. The angle of the asymptote are ___$\pi, \pm\frac{\pi}{3}$___ if n=5, m=2.
   iv. If n=5, m=2, the closed-loop system will be ___stable or unstable___ when K is very large.