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淡江大學八十九學年度碩士班招生考試試題

系別：電機工程學系

科目：控制系統

本試題共 1 頁

1. A step response of a second-order system is described by

$$c(t) = 1 - 1.333e^{-5t} + 0.333e^{-20t}$$

Find the damping ratio of the system. (10%)

2. Consider the following transfer function

$$T(s) = \frac{18}{s^8 + s^7 + 12s^6 + 22s^5 + 39s^4 + 59s^3 + 48s^2 + 38s + 20}$$

Find the number of poles in the right half-plane, in the left half-plane, and on the $j\omega$ - axis. (15%)

3. For the unity feedback system of Figure 1, where

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

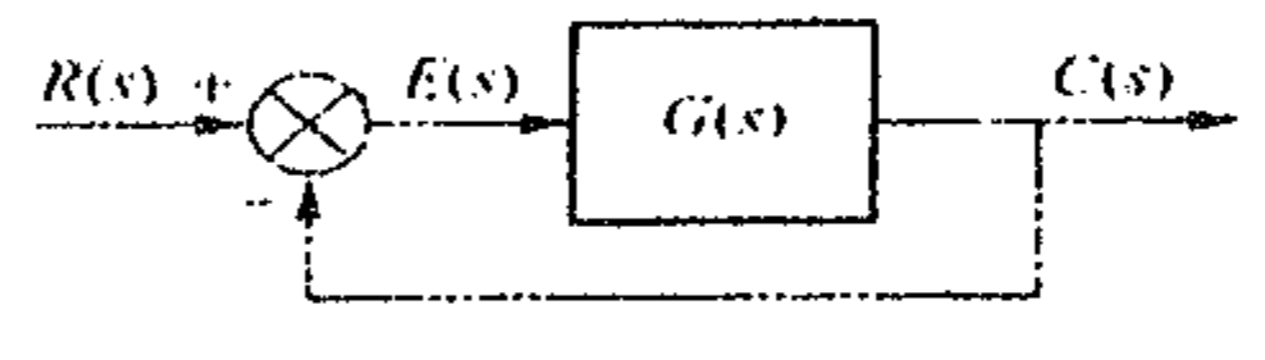


Figure 1

- (a) Find the range of K to keep the system stable. (5%)
- (b) Find the breakaway point. (5%)
- (c) Find the centroid of asymptotes. (5%)
- (d) Find the exact point and gain where the locus crosses the $j\omega$ -axis. (5%)
- (e) Plot the root locus for $K \geq 0$. (5%)
- (f) Find K such that the system has the smallest settling time and overshoot. (5%)

4. Consider the unity feedback system of Figure 1, where

$$G(s) = \frac{K}{s(s+4)(s+6)}$$

- (a) Find the gain K such that the system is operating with a damping ratio of 0.504. (10%)
- (b) Find the location of the dominant pole in part (a). (5%)
- (c) Find the settling time ($\pm 2\%$ of the final value) of the uncompensated system. (5%)
- (d) Assume a cascade compensator $\frac{s+5}{s+p_c}$ for the system that will reduce the settling time by a factor of 2 while maintaining the same damping ratio. Find the value of p_c . (10%)
- (e) Identify the design compensator (Lead or lag? Why?) (5%)

5. Consider the unity feedback system of Figure 1, where

$$G(s) = \frac{K}{s^n(s+a)}$$

Find the value of n, K and a to meet specifications of 25% overshoot and velocity error constant $k_v = 100$. (10%)