

國立臺灣科技大學 112 學年度碩士班招生試題

系所組別：自動化及控制研究所碩士班

科目：自動控制系統

(總分為 100 分；所有試題務必於答案卷內頁依序作答，否則不予計分)

1. The unit-step response of a linear control system is shown in Figure P1. Find the transfer function of a second order prototype system to model the system. (15%)

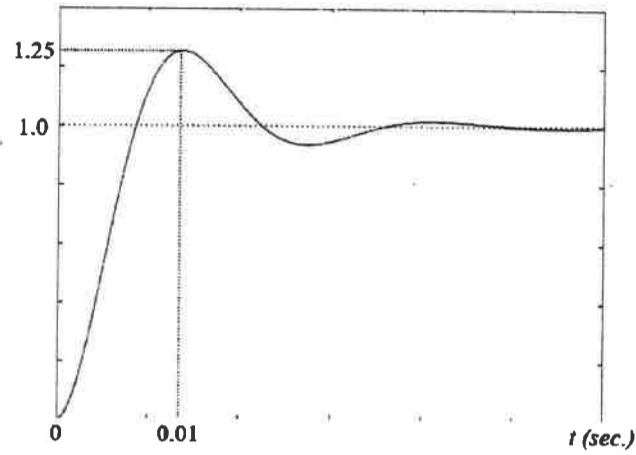


Figure P1

2. The following differential equation represents a linear time-invariant system, where $r(t)$ denotes the input and $y(t)$ the output. Find the transfer function $Y(s)/R(s)$ for the system. Assume zero initial condition. (15%)

$$\frac{d^2 y(t+1)}{dt^2} + 4 \frac{dy(t+1)}{dt} + 5y(t+1) = \frac{dr(t)}{dt} + 2r(t) + 2 \int_{-\infty}^t r(\tau) d\tau$$



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3. The block diagram of a feedback control system is shown in Figure P3. The error signal is defined to be $e(t)$. (20%)
- (a) Find the steady-state error of the system in terms of K and K_f when the input is a unit-ramp function. Give the constraints on the values of K and K_f so that the answer is valid. Let $n(t)=0$ for this part. (10%)
- (b) Find the steady-state value of $y(t)$ when $n(t)$ is a unit-step function. Let $r(t)=0$. Assume that the system is stable. (10%)

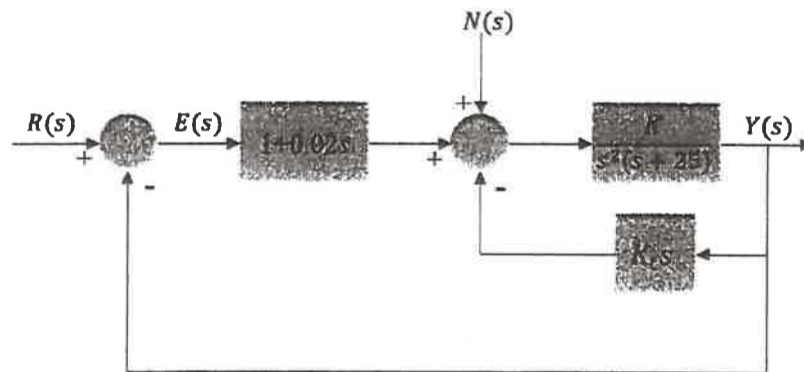
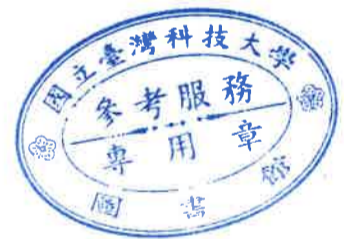


Figure P3



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4. Plot the root locus for the unity feedback system shown in Figure P4, where

$$G(s) = \frac{K(s+2)(s^2+4)}{(s+5)(s-3)}$$

For what range of K will the poles be in the right half-plane?

(15%)

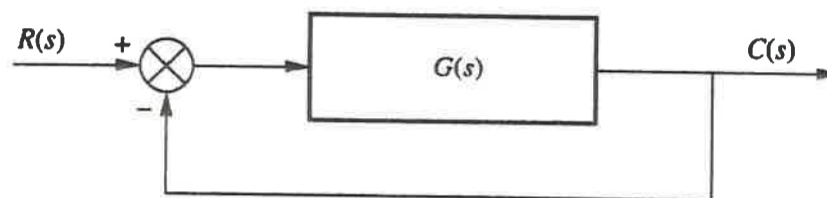


Figure P4.

5. If the system of Figure P5 operates with a damping ratio of 0.517 for the dominant second-order poles, find the location of all closed-loop poles and zeros. (20%)

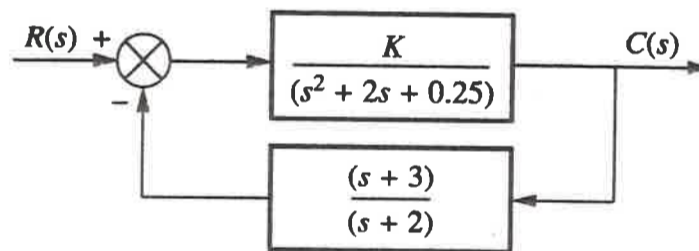


Figure P5.

6. Find the total steady-state error due to a unit step input and a unit step disturbance in the system of Figure P6. (15%)

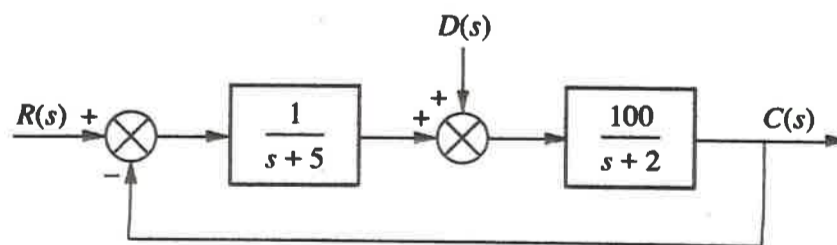


Figure P6.

