

國立高雄海洋科技大學 99 學年度碩士班入學考試
 輪機工程研究所-自動控制學試題
 (本試題作答不需要用計算機)

1. (25%) Consider the following differential equations that describe a multivariable system:

$$\frac{d^2 y_1(t)}{dt^2} + 4 \frac{dy_1(t)}{dt} - 3y_2(t) = u_1(t) + 2w(t)$$

$$\frac{dy_1(t)}{dt} + \frac{dy_2(t)}{dt} + y_1(t) + 2y_2(t) = u_2(t)$$

Find the state equation and output equation under the assumption of $x_1(t) = y_1(t)$,

$$x_2(t) = \frac{dy_1(t)}{dt}, \quad x_3(t) = y_2(t).$$

2. (25%) Find the inverse Laplace transform $f(t)$ of the following functions:

(a) $F(s) = \frac{s+6}{s(s+3)(s+1)^2}$, (b) $F(s) = \frac{96(s+5)(s+12)}{s(s+8)(s+6)}$

3. (25%) For the unity feedback system of Fig. 1 with $G(s) = \frac{(s-2)(s-8)}{(s+2)(s+8)}$.

- (a) Sketch the root locus for $K > 0$.
- (b) Find the breakaway and break-in points.
- (c) Find the frequency and gain at imaginary-axis crossing.
- (d) Determine the range of K to ensure stability.

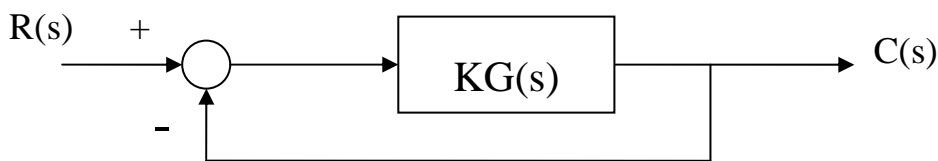


Fig. 1

4. (25%) For the unity feedback system of Fig. 1 with $G(s) = \frac{(s+5)}{s(s+6)(s+7)(s+8)}$.

- (a) In order to obtain the finite steady state error, which signal should be used? (step, ramp, and parabola)
- (b) Find the value of K to achieve that the steady state error equal to 0.2.