編號： 170

國立成功大學 108 學年度碩士班招生考試試題

系　所：電機工程學系

考試科目：控制系統

考試日期：0223，節次：2

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Consider the system shown in *Fig.* 1, where $F(s)=1$, $W(s)=0$, $V(s)=0$, $D_{cl}(s)=K(s+2)$, $G(s)=(s+2)/(s-2)^2$, and $H(s)=1/s$.
   (a) Apply **Nyquist plot method** to figure out the range of K such that the controlled system from $R(s)$ to $Y(s)$ is stable. (20%)
   (b) Determine the gain margin of this system suppose $K=10$. (10%)

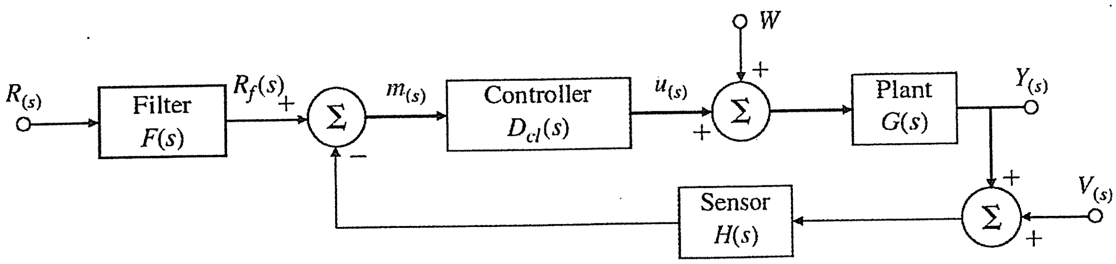

Fig. 1

2. Suppose the lead controller is designed by $C(s)=K(s+z)/(s+p)$, where K, p, and z are positive constants.
   (a) Give the phase $\phi(\omega)$ of $C(s)$. (4%)
   (b) Derive and determine the frequency $\omega_{\max}$ in which the phase of the controller is maximum. (8%)
   (c) Calculate the corresponding value $\tan(\phi(\omega_{\max}))$. (8%)

3. A feedback control system has a characteristic equation $s^3+(2+K)s^2+10s+(5+20K)=0$. The parameter K must be positive.
   (a) What is the maximum value K can be assume before the system becomes unstable? (15%)
   (b) Determine the frequency of oscillation when K is equal to the maximum value. (10%)

4. For the system shown in *Fig.* 2, find the sensitivity of the steady-state error for changes in K_1 and in K_2, when $K_1=100$ and $K_2=1$. Assume step inputs for both the input and the disturbance. (25%)

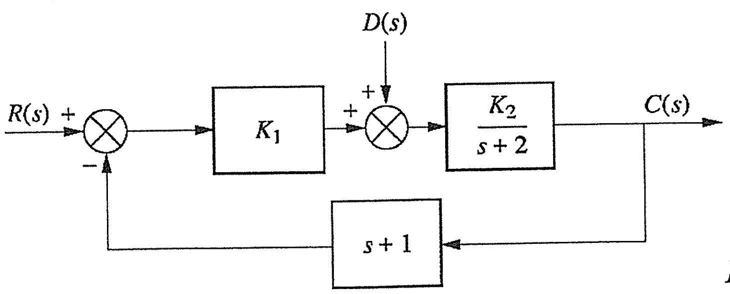

Fig. 2