國立成功大學

110學年度碩士班招生考試試題

編　號：132

系　所：航空太空工程學系

科　目：自動控制

日　期：0202

節　次：第 1 節

備　註：不可使用計算機

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※ 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 a system represented by the following differential equations:

$$Ri_1(t)+L_1\frac{di_1(t)}{dt}+v(t)=v_a(t),\quad L_2\frac{di_2(t)}{dt}+v(t)=v_b(t),\quad \text{and}\quad i_1(t)+i_2(t)=C\frac{dv(t)}{dt},$$

where R, L_1, L_2, and C are given constants, and v_a and v_b are inputs. Draw a block diagram to represent the system where the output is v. Also, obtain the transfer functions for $\frac{V(s)}{V_a(s)}$ and $\frac{V(s)}{V_b(s)}$. (25%)

2. For a system transfer function given as:

$$\frac{Y(s)}{R(s)}=\frac{s+8}{s^2+4s+8}\quad \text{and}\quad R(s)=\frac{1}{s},$$

derive the output function y(t), the rise time t_r, and the peak time t_P, where the rise time is defined as the first time when y(t)=r(t) evaluated from t=0. (25%)

3.

(a). Sketch the Nyquist and Bode plot of the following system shown in Fig.3 with $K = 1$, please also provide the Nyquist $\mathcal{D}$ contour plot. (20%)

(b). Determine the range of K, such that the closed-loop is stable by Nyquist plot. (5%)

(c). Determine the gain K, such that the gain margin of the system is 6dB. (5%)

$$KG(s) = \frac{K(s-5)}{s(s+10)}$$

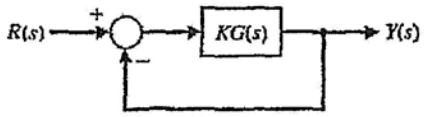

Fig.3

4.

Consider the system shown in Fig. 4. Design a controller $G_c(s)$ such that the closed-loop system satisfies the following system specifications. (10%)

(a). zero steady state error to a step input $R(s)$, and

(b). the complex closed-loop poles having

damping ratio = 0.5 and natural frequency = 1.5 rad/s

Sketch the root locus of the compensated system $kG_c(s)G(s)$. (10%)

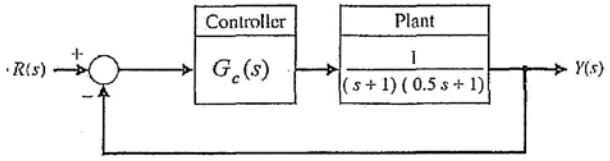

Fig.4