(1) (15%) 圖 A.1 為一動態避震器系統之示意圖，其 F(t) 為輸入而 $y_1(t)$ 及 $y_2(t)$ 為輸出，試求描述該系統之微分方程式(differential equations)。

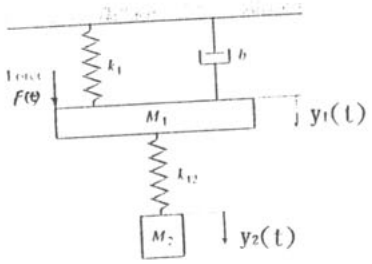

圖 A.1

(2) (15%) 有單一回授控制系統(unity feedback control system)之開回路系統轉移函數 $G(s)$ 為

$$G(s)=\frac{K}{s-1}$$

試利用極座標作圖法(polar plot)，說明使閉回路系統穩定之增益參數 K 的範圍。

(3) (20%) 圖 A.2a 為一回授系統之控制方塊圖，圖 A.2b 為其各個控制方塊圖之轉移函數的頻率響應曲線圖(frequency response curves)，試求該系統 R(s)到 Y(s)之閉回路轉移函數，並以此例說明什麼是系統頻寬(bandwidth)。

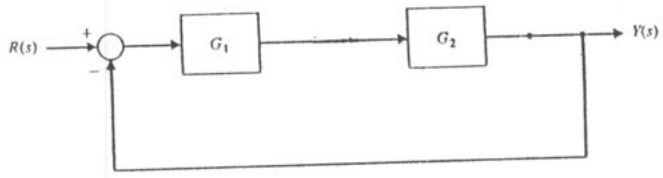

圖 A.2a

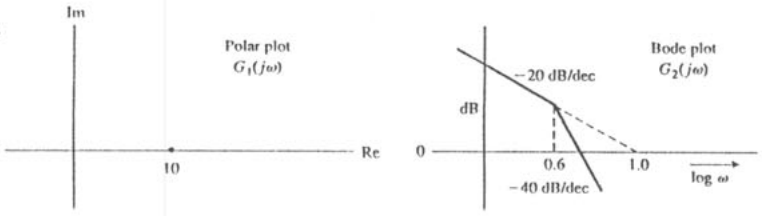

圖 A.2b

(背面仍有題目,請繼續作答)

4. Figure 4(a) shows the vehicle distance control system of the automated highway system. A position control system for maintaining the distance between vehicles is shown in fig.1(b). Select K_a and K_t so that the steady state error for a ramp input is less than 25 % of the input magnitude, A, of the ramp $R(s)= A/s^2$. The response to a step command should have an overshoot of less than 3 % and a settling time (2 % criterion) of less than 1.5 seconds. (15%)

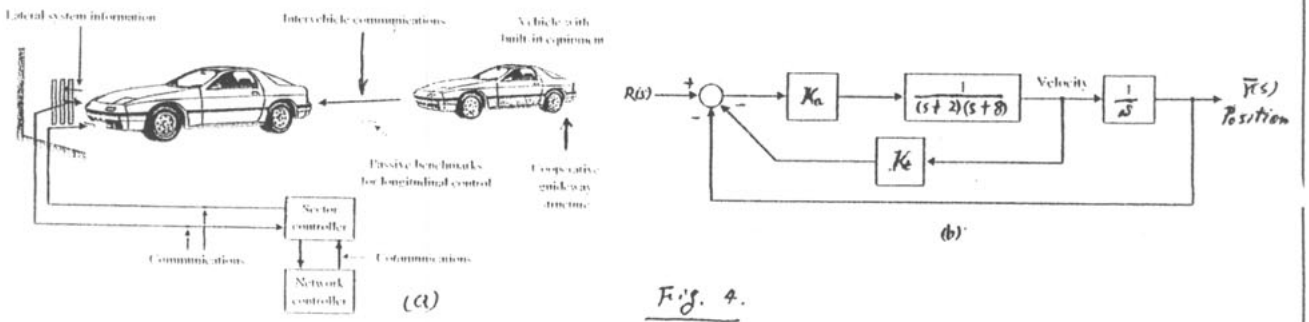

Fig. 4.

5. A robot gripper , shown in Fig.5(a) is to be controlled so that it closes to an angle θ by using a dc motor control system, as shown in Fig.5(b). The model of the control system is in Fig .5(c), where Km=30, Rf=1Ω , Kf =Ki=1 and J=0.1, and b=1.

(a) Find the response $\theta(t)$ of the system to a step change in $\theta_d(t)$ when K=20. (10%)
(b) Assuming $\theta_d(t)=0$, find the effect of a load disturbance $T_d(s) = A/s$. (5%) } (≧ 20%)
(c) Determine the steady state error , when the input is r(t)=t, t>0. (5%)
(assume that Td=0)

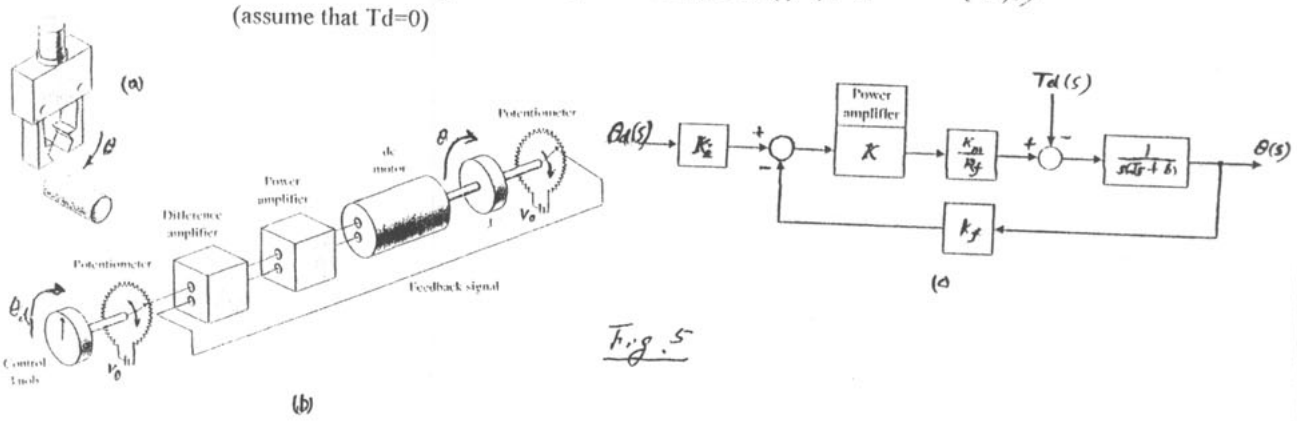

Fig. 5

6. A robot steering a motorcycle system is shown in the Fig.6(a) and the block diagram of the system is shown in the Fig.6(b).

Determine the range of K for stable operation of the cycle when $\alpha_1 = g/h = 9$, $\alpha_2 = V^2/hc = 2.7$, and $\alpha_3 = V/hc = 1.35$, we assume the motorcycle is moving with a constant velocity V=2 m/s. The time constant (τ) of the controller is equal to 0.2 sec, and K>0. (15%)

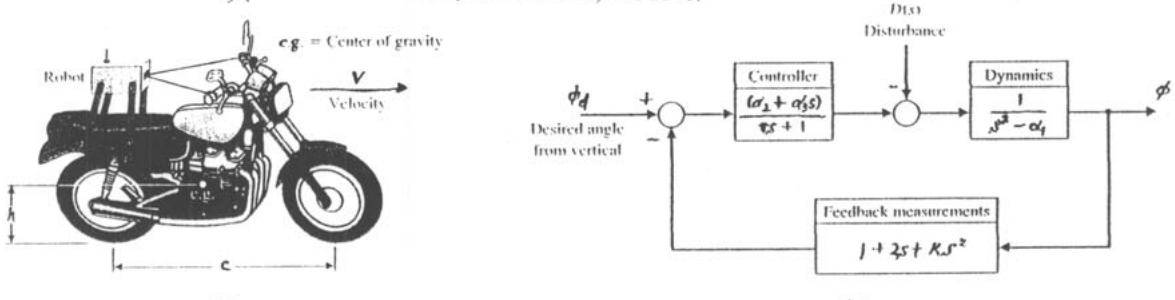

Fig. 6