

國立臺灣科技大學
八十八學年度碩士班招生考試試題

系所別：機械工程系研究所

組別：丁組

科目：線性系統控制

(25%) 1. A unity feedback second-order system, the unit step response is shown in fig 1.

(1) Find the closed loop transfer function, (5%), and open loop transfer function. (5%)

(2) Draw the bode plot of open system, (5%), and point out the gain margin and phase margin. (5%)

(3) How to adjust controller to get a reasonable system. (5%)

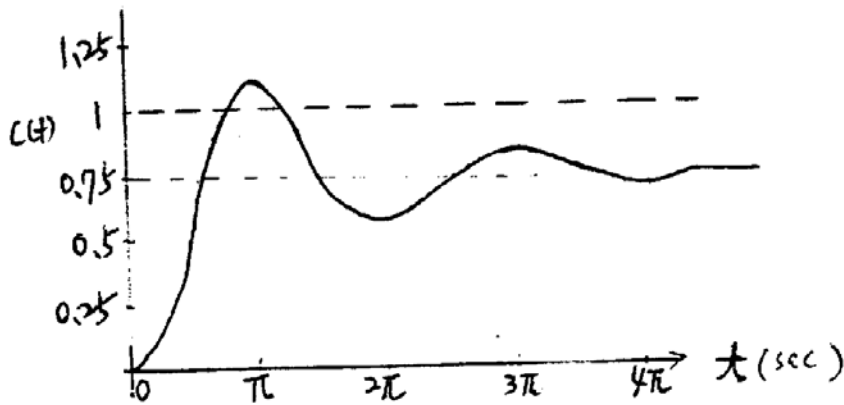


Fig. 1.

(25%) 2. For a stepping motor shown in fig 2., if two coils have same inductance L and resistance R , and the load has a inertia J and external torque $T_b(t)$. If $V_1=V_2=\text{constant}$, and $\theta(t) \ll \theta_0$.

(1) Find the linearized transfer function between $\theta(s)$ and $T_b(s)$. (10%)

(2) Calculate the natural frequency and damping ratio, in the case of $R \gg L$ and $L \gg R$. (10%)

(3) How to reduce the resonant effect and give high-speed operation. (5%)

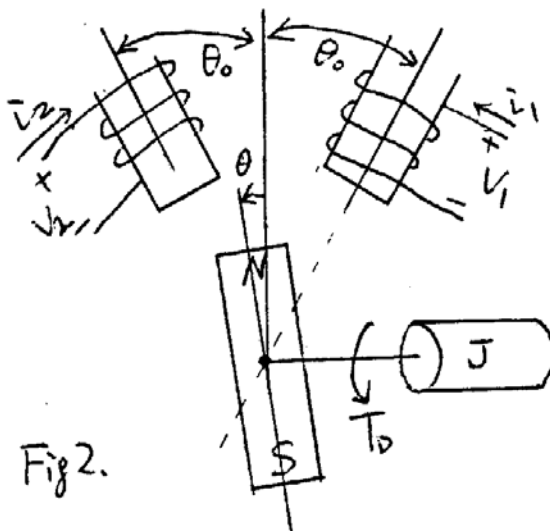


Fig. 2.

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(25%) 3. For an error feedback control system, shown in fig 3.

(1) Draw root contours, (10%), and discuss the effects of varying K and a on system dynamics. (5%)

(2) Determine the values of K and a from root contours, so that the settling time less than 8 sec., and damping ratio larger than 0.5. (10%)

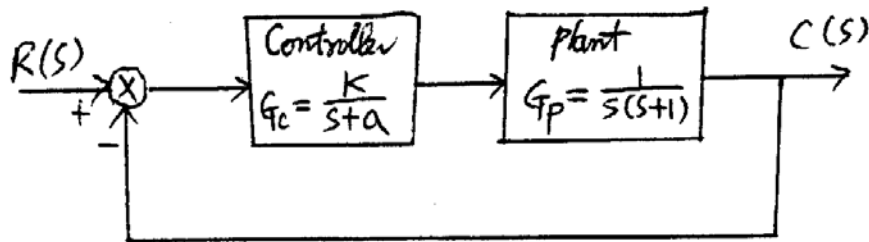


Fig 3.

(25%) 4. For a computer control positioning system; the hardware consist of precision linear stage, DC motor, ball screw, a simple voltage amplifier and others. The control algorithms include current control and PID position control.

(1) Sketch the hardware connection to complete the overall control system, (5%), and draw block diagram with each variable and transfer function. (5%)

(2) If servo update interval is T , write down the PID subprogram in C language, (5%), and main program to move position from PA to PB with velocity V . (10%)