

淡江大學 95 學年度碩士班招生考試試題

66-1

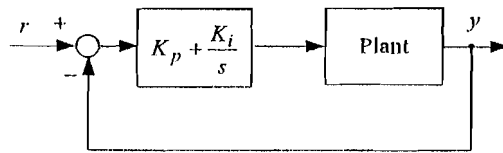
系列：機械與機電工程學系

科目：自 動 控 制

准帶項目請打「V」
✓ 簡單型計算機

本試題共 2 頁

5. (15%) A control system in the laboratory has a PI control law as shown in the following block diagram. A technician is asked to **tune** the controller such that the system's step response is as fast as possible and with approximately 10% overshoot. The technician has a **function generator** which can be used to produce step command to the input r and an **oscilloscope** (示波器) which can be used to observe r and y . Without knowing the plant's transfer function, how the controller can be tuned to achieve the desired response?



6. (20%) The following figures show two different implementations of PD (proportional plus derivative) controlled closed-loop systems. K_p and K_d are the proportional and derivative gain, respectively, θ^* and T_L are the command and the disturbance input, respectively, and θ is the output. Answer the following questions.

- Compare the **tracking** performance of these two controllers?
- Compare the **disturbance rejection** performance of these two controllers?
- In what applications the controller shown in Figure 6b) is more suitable than the controller shown in Figure 6a)?

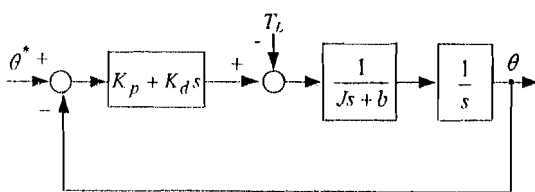


Figure 6 a)

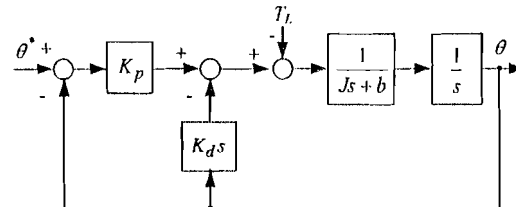


Figure 6 b)

7. (20%) The table shown in Figure 7a) is driven by a dc motor horizontally. A tool is fastened to the table and controlled by a position feedback controller. The transfer function of the closed-loop system is $\frac{x(s)}{x^*(s)} = \frac{12s + 36}{s^2 + 12s + 36}$, where x is the position of the tool, and x^* is the position command. If the tool is at $x = 0$ initially, as shown in Figure 7a). Then a **sinusoidal** command between 0 to 1 meter is given to x^* , as the waveform shown in Figure 7b). Find the steady state position trajectory of the tool ?

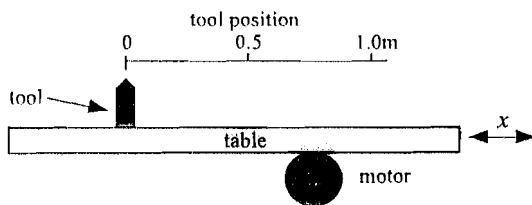


Figure 7 a)

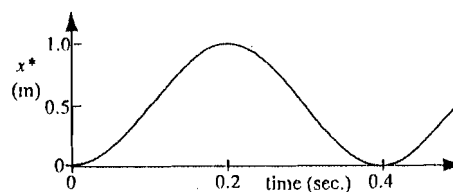


Figure 7 b)

淡江大學 95 學年度碩士班招生考試試題

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系別：機械與機電工程學系

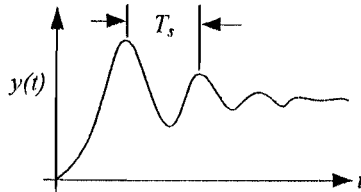
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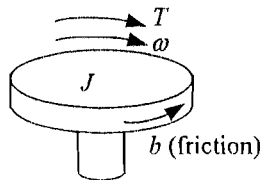
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1. (10%) The transfer function a system is: $\frac{y(s)}{r(s)} = \frac{10}{(s^2 + 3s + 12)}$. Its unit step response is shown in the following figure. What is the resonance period $T_s = ?$

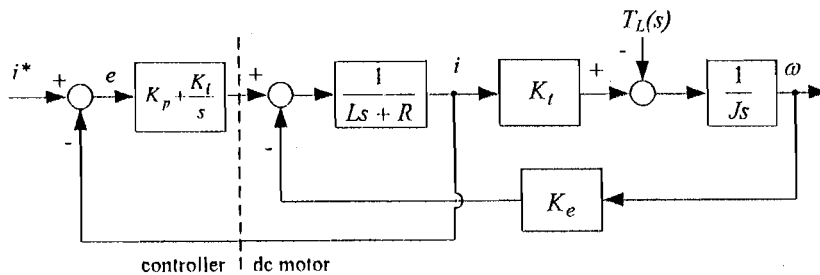


2. (10%) The moment of inertia, viscous damping coefficient, and rotating speed of the following table is J , b , and ω , respectively. If the table is at standstill when a constant torque T is applied, let this instance be $t = 0$, find $\omega(t)$ for $t \geq 0$?



3. (10%) A nonlinear system has the following mathematical model: $\frac{dx(t)}{dt} = x^2(t) \cdot u(t) + 2$, where $u(t)$ is the input and $x(t)$ is the output. If the system is to operate near $x = 1$, find the linearized system equation at this point?

4. (15%) A dc motor has a closed-loop current control is shown in the following figure. K_p and K_i are the proportional and integral gain, respectively, i and i^* are the feedback and the command current, respectively, and T_L is the external load torque. Find the steady state current error for $i^* = 0$ and $T_L = 1.0 \text{ Nm}$.



◀ 注意背面尚有試題 ▶