114AT02

國立臺北科技大學 114 學年度碩士班招生考試

系所組別：1501 自動化科技研究所

第二節　自動控制　試題（選考）

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Simplify the block diagram shown in Figure 1 and obtain the closed-loop transfer function C(s)/R(s)? (20%)

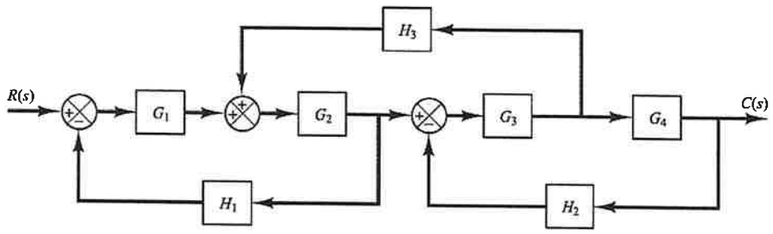


Figure 1

2. Obtain the transfer function Xo(s)/Xi(s)of the mechanical system shown in Figure 2(a). Also obtain the transfer function Eo(s)/Ei(s)of the electrical system shown in Figure 2(b). Show that these transfer functions of the two systems are of identical form and thus they are analogous systems. (20%)

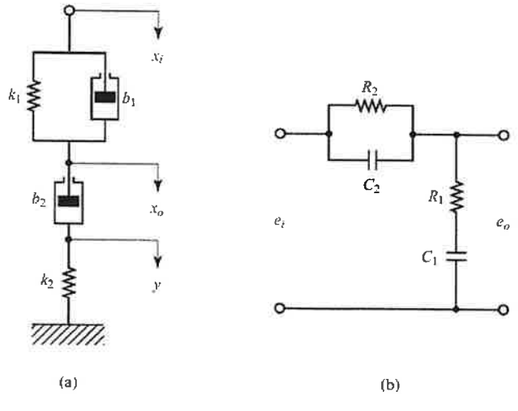


Figure 2

3. Consider the gear-train system shown in Figure 3, where a load is driven by a motor through the gear train. Assuming that the stiffness of the shafts of the gear train is infinite (there is neither backlash nor elastic deformation) and that the number of teeth on each gear is proportional to the radius of the gear, obtain the equivalent moment of inertia and equivalent viscous-friction coefficient referred to the motor shaft and referred to the load shaft. u3/u2 = N3/N4. In Figure 3 the numbers of teeth on gears 1,2,3,and 4 are N1,N2,N3,and N4, respectively. The angular displacements of shafts,1,2,and 3 are u1,u2,and u3,respectively. Thus, and u2/u1 = N1/N2 The moment of inertia and viscous-friction coefficient of each gear-train component are denoted by J1, b1; J2, b2; and J3, b3; respectively. (J3 and b3 include the moment of inertia and friction of the load. Obtain the equivalent moment of inertia J1eq and viscous-friction coefficient b1eq of the gear train referred to shaft 1? (20%)

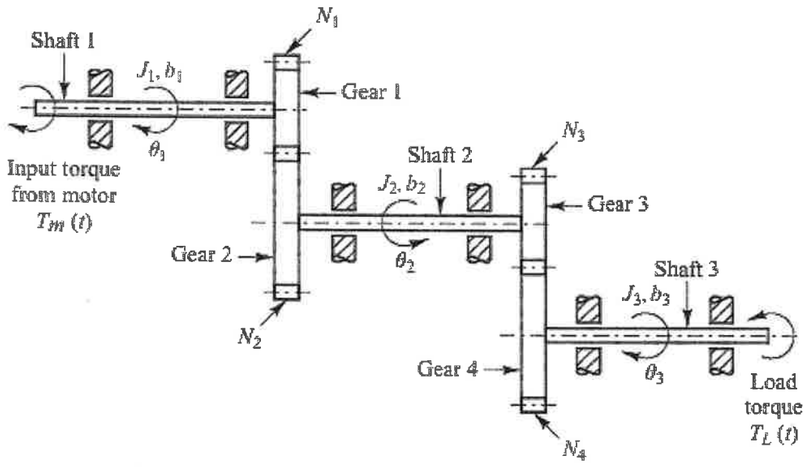
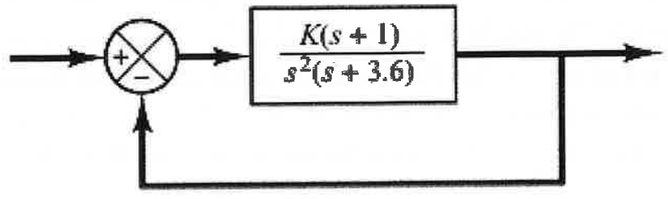


Figure 3

注意：背面尚有試題

4. Sketch the root loci for the system shown in Figure 4. (20%)



5. Consider the system defined by

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -25 & -4\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1 & 1\\ 0 & 1\end{bmatrix}\begin{bmatrix}u_1\\ u_2\end{bmatrix}$$

$$\begin{bmatrix}y_1\\ y_2\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$

Obtain the sinusoidal transfer functions $\frac{Y_1(j\omega)}{U_1(j\omega)},\frac{Y_2(j\omega)}{U_1(j\omega)},\frac{Y_1(j\omega)}{U_2(j\omega)},\frac{Y_2(j\omega)}{U_2(j\omega)}$

(In deriving $\frac{Y_1(j\omega)}{U_1(j\omega)},\frac{Y_2(j\omega)}{U_1(j\omega)}$, we assume that $U_2(j\omega)=0$; similarly, in obtaining $\frac{Y_1(j\omega)}{U_2(j\omega)},\frac{Y_2(j\omega)}{U_2(j\omega)}$, we assume that $U_1(j\omega)=0$) (20%)