系所組別： 系統及船舶機電工程學系丁組

考試科目： 自動控制

考試日期：0219，節次：2

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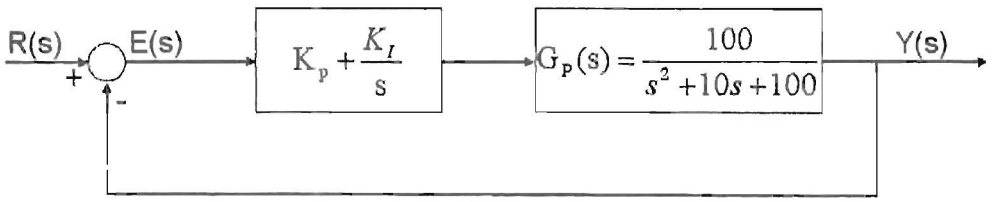
1、Sketch the root locus of a unity feedback system whose transfer function is (10%)

$$G(s)=\frac{K(s+2)}{(s+1)(s^2+6s+10)}$$

2、A control system with a type 0 process $G_p(s)$ and a PI controller is shown in Fig 1. (20%)

(a) Find the value of K_I so that the ramp-error constant K_V is 10.

(b) Find the value of K_P so that the magnitude of the imaginary parts of the complex roots of the characteristic equation of the system is 15 rad/sec. Find the roots of the characteristic equation.



3、If the following transfer function is excited with an input signal of the form: (20%)

$$y(t)=4.4\sin(400t)$$

Calculate at the following input conditions： (a) Magnitude in dB、(b) Magnitude as a gain、(c) Phase (angle in degrees)、(d) Steady-state, sinusoidal output

$$T(s)=\frac{25}{(\frac{s}{200}+1)}$$

4、Consider the following dynamic system (20%)

$$\frac{d}{dx}\begin{bmatrix}x_1\\x_2\end{bmatrix}=\begin{bmatrix}0 & 1\\-2 & -3\end{bmatrix}\begin{bmatrix}x_1(t)\\x_2(t)\end{bmatrix}+\begin{bmatrix}0\\1\end{bmatrix}u(t)$$

(a) Determine the state-transition matrix $\Phi(t)$

(b) When the input is $u(t)=1$ for $t\geq 0$, and the initial state is zero, determine the time response (state vector x(t)) of the above system

(背面仍有考題)

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5、A controlled process is modeled by the following state equations. (15%)

$$\frac{dx_1(t)}{dx} = x_1(t) - 2x_2(t) \qquad \frac{dx_2(t)}{dx} = 10x_1(t) + u(t)$$

The control u(t) is obtained from state feedback such that

$$u(t) = -k_1 x_1(t) - k_2 x_2(t)$$

where k_1 and k_2 are real constants. Determine the region in the k_1-versus-k_2 parameter plane in which the closed-loop system is asymptotically stable.

6、Determine the transfer function $\frac{x(s)}{F(s)}$ for the following system. where F：force input, m：mass, k：spring constant, b1,b2：damping constants, x：displacement of the mass (15%)