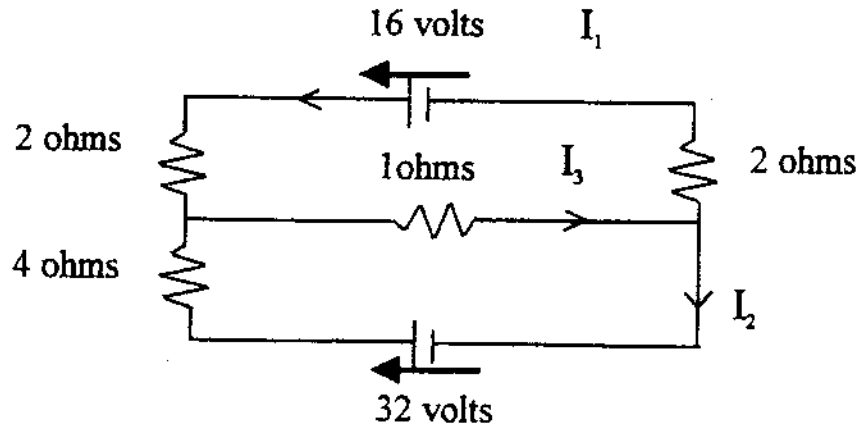
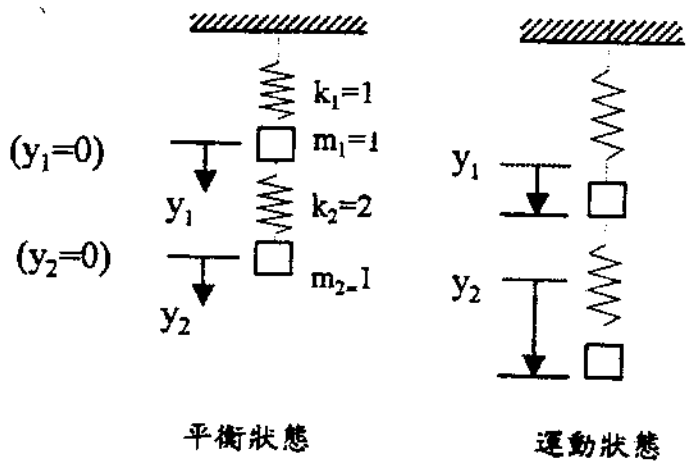
(1).(15%)試以高斯消去(Gauss Elimination)法，求解下列線性電路系統之電流量 I_1,I_2與I_3。



(2).(15%)試求解下列線性彈簧－質點系統之質點位移 y_1與y_2。



(3).(15%) Find the steady-state oscillation of

$$y'' + 0.02y' + 25y = r(t)$$

where r(t) is given as

$$r(t)=\begin{cases} t+\dfrac{\pi}{2} & \text{if } -\pi < t < 0 \\ -t+\dfrac{\pi}{2} & \text{if } 0 < t < \pi \end{cases}$$

here

$$r(t+2\pi)=r(t)$$

(背面仍有題目,請繼續作答)

(4).(20%) Let us first consider the temperature (T) in a long thin bar or wire of constant cross section and homogeneous material, which is oriented along the x-axis and is perfectly insulated laterally.

(a) Write down the differential equation for the temperature

(b) Derive the general solution of this differential equation

(c) Find the temperature in a laterally insulated bar of length L whose ends are kept at temperature 0, assuming that the initial temperature is

$$T(0,x)=\begin{cases} x & \text{if} \quad 0<x<L/2 \\ (L-x) & \text{if} \quad L/2<x<L \end{cases}$$

(5).(15%)Classify each of the following differential equations by stating the order, whether the equation is homogeneous or non-homogeneous, and it is linear or nonlinear (in which variable.)

(a) $d^2y/dx^2+3x^2=2(dy/dx)^2$

(b) $dy/dx+y/x=xy^2$

(c) $dy/dx=(x+y)/(x-y)$

(d) $(3x^2+y\cos x)dx+(\sin x)dy=0$

(e) $d(yu)=y^2du$

(6).(10%)Solve $dy/dx=(y+x^4)/x$

(7).(10%)Let S be a closed regular surface and $\vec{r}$ denote the position vector of any point (x, y, z) measured from an origin O. Evaluate

$$\iint_S \frac{\vec{n}\cdot\vec{r}}{r^3}dS$$

in which $\vec{n}$ is the outward unit normal vector to dS and $r=|\vec{r}|$.