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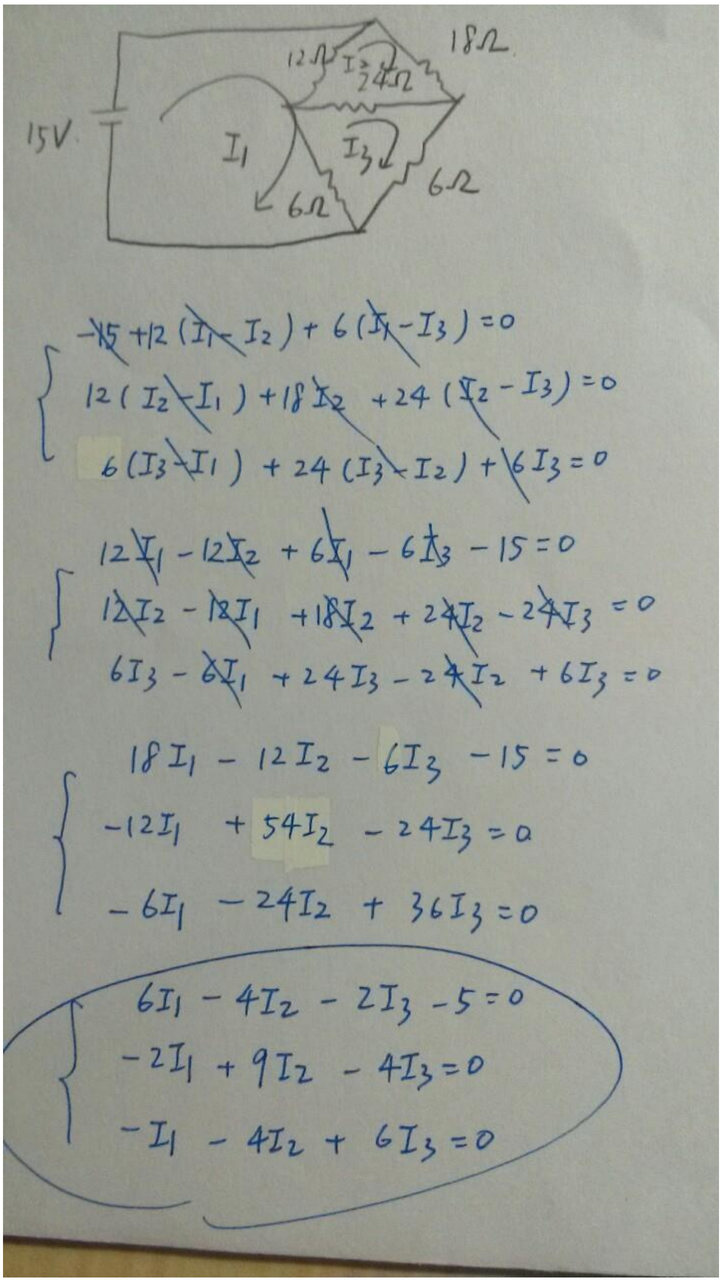
Problem1:

(1)



(2)

我用 Jacobi Method，精確度到小於 10^(-4)，迴圈數總共計算 33 次。

Problem2:

(1)

2、(1).

$$\begin{cases} x(t+\Delta t) = x(t) + V(t)\Delta t \\ V(t+\Delta t) = V(t) + a(t)\Delta t \end{cases}$$

Eular's method.

$$m\frac{d^2}{dt^2}x(t) + \beta\frac{d}{dt}x(t) + kx(t) = 0.$$

$$m\,a(t) + \beta V(t) + k\,x(t) = 0.$$

$$a(t) = \frac{1}{m}(-\beta V(t) - k\,x(t)).$$

$$\begin{cases} x(t+\Delta t) = x(t) + V(t)\Delta t \\ V(t+\Delta t) = V(t) - \frac{1}{m}(\beta V(t) + kx(t))\,dt \end{cases}$$

$x(0) = -10.(cm) = -0.1\,(m).$

$V(0) = 0\,(m/s).$

(2)

找最高和最低點，得到半周期，再乘以 2 等於週期(T)，頻率(f)=1/T。

Porblem3

(a)

3.

(a). $\varepsilon(t) = IR + V_c(t).$

$$I_c(t) = C\frac{dV_c(t)}{dt}.$$

$$\varepsilon(t) = RC\frac{dV_c(t)}{dt} + V_c(t)$$ #.

(b)

(b).

$$V_c(t+\Delta t) = V_c(t) + \frac{dV_c(t)}{dt}\Delta t.$$

$$\frac{dV_c(t)}{dt} = \frac{\varepsilon(t) - V_c(t)}{RC}$$

$$V_c(t+\Delta t) = V_c(t) + \left(\frac{\varepsilon(t) - V_c(t)}{RC}\right)\Delta t.$$

(c)(d)

電壓源依時間做變化，Vc(t)依(b)小題的公式，VR(t)=E-Vc(t)即可得 VR(t)。

Problem4:

(a)

4. (a.)

$$V_s(t) = L\frac{dI(t)}{dt} + I(t)R + V_c(t)$$

$$V_s(t) = L\frac{dI(t)}{dt} + I(t)R + \frac{1}{C}\int I(t)\,dt + \underbrace{V_c(0)}_{=0}.$$

$$\frac{dV_s(t)}{dt} = L\frac{d^2I(t)}{dt^2} + R\frac{dI(t)}{dt} + \frac{1}{C}I(t).$$

#

(b)

(b).

$$\begin{cases} I(t+\Delta t) = I(t) + I'(t)\Delta t \\ I'(t+\Delta t) = I'(t) + I''(t)\Delta t \end{cases}$$

$$I''(t) = \frac{1}{L}\left(\frac{dV_s(t)}{dt} - R\,I'(t) - \frac{1}{C}I(t)\right)$$

$$\begin{cases} I(t+\Delta t) = I(t) + I'(t)\Delta t \\ I'(t+\Delta t) = I'(t) + \Delta t\left(\frac{1}{L}\right)\left(\frac{dV_s(t)}{dt} - R I'(t) - \frac{1}{C}I(t)\right). \end{cases}$$

$$V_s(0) = L\frac{dI(0)}{dt} + \underbrace{I(0)R}_{0} + \underbrace{V_c(0)}_{0}$$

$$I(0)=0, \quad \frac{dI(0)}{dt} = \frac{V_s(0)}{L} = \frac{1}{L}.$$

(c)(d)

同上。

Problem5:

(a)

(5). (a).

$$a = \frac{GM_s}{r_0^2}$$

$$a_x = -\frac{d^2x_p}{dt^2} = \frac{-GM_s}{r_0^2} \times \frac{x_p}{r_0} \quad (r_0: \text{Distance}.\ M_s: \text{mass of sun})$$

$$a_y = -\frac{d^2y_p}{dt^2} = \frac{-GM_s}{r_0^2} \times \frac{y_p}{r_0} \quad \left(r_0 = \sqrt{(x_p^2+y_p^2)}\right) \quad \#$$

(b)

$$a_y = -\frac{d^2 y_p}{dt^2} = \frac{-GM_s}{r_0^2} \times \frac{y_p}{r_0} \quad (r_0 = \sqrt{(x_p^2 + y_p^2)}\,)$$ #

(b).

$$\frac{V_c^2}{\cancel{x_0}} = a = \frac{GM_s}{r_0^2} \qquad (G : 6.67 \times 10^{-11}\ (N \cdot m^2 / kg^2))$$

$$V_c = \sqrt{\frac{GM_s}{r_0}}$$

(c).

$$x(t+\Delta t) = x(t) + x'(t)\,\Delta t$$

(c)

(5). (c).

$$x(t+\Delta t) = x(t) + x'(t)\,\Delta t$$

$$x'(t+\Delta t) = x'(t) + \underbrace{x''(t)}_{\frac{-GM_s}{r_0^2} \times \frac{x(t)}{r_0}}\,\Delta t$$

$$x(0) = r,\quad x'(0) = 0.$$

$$y(t)+\Delta t) = y(t) + y'(t)\,\Delta t$$

$$y'(t+\Delta t) = y'(t) + \underbrace{y''(t)}_{\frac{-GM_s}{r_0^2} \times \frac{y(t)}{r_0}}\,\Delta t$$

$$y(0) = 0,\quad y'(0) = \sqrt{\frac{GM_s}{r_0}}.$$

(5). (a).

$$a = \frac{GM_s}{r_0^2}$$

(d)

橢圓:

任意一點到兩焦點的距離要接近半長軸。

我計算出來的差距約為 10^(10)。

半長軸:

先算半圈的長度，再除以 2。

週期:

先算半圈的時間，再乘以 2。

(e)

我用雙迴圈，x 軸是 R^3，y 軸是 T^2，每次不一樣的 k 值就算一次 R 和 T，R^3 和 T^2 成一直線，所以 R^3 和]T^2 正比。