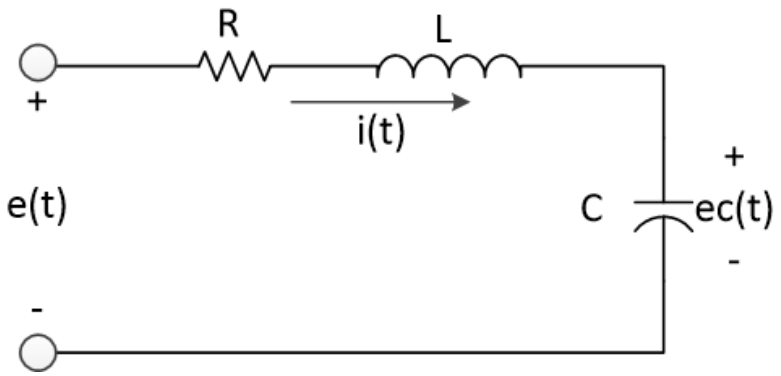
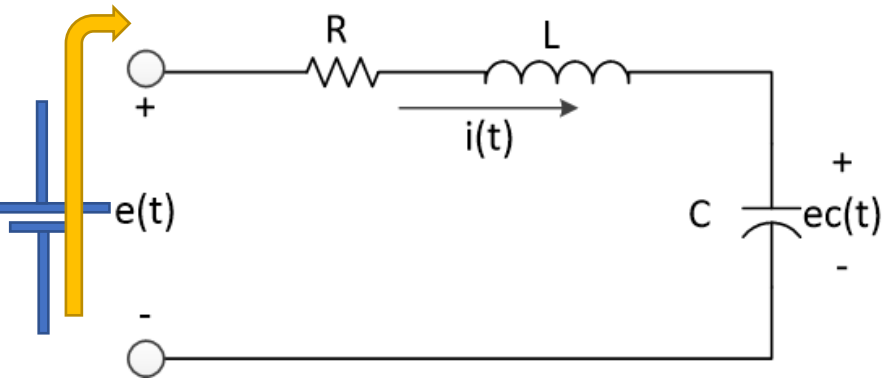


HW03-1

- 參考左圖，設定兩個狀態，電容電壓$e_C(t)$及電感電流$i(t)$，輸入變數為輸入電壓$e(t)$。
- 請寫出系統狀態方程式(矩陣形式)，(R=0.5$K\Omega$, L=5mH, C=0.01μF)
- 若輸入電壓為方波訊號，振幅為±5V，頻率為1KHz，請模擬並繪出電容電壓響應圖、電感電流響應圖以及輸入電壓波形圖。
- 模擬圖說明
- 程式碼以及其註解

請寫出系統狀態方程式(矩陣形式)，(R=0.5$K\Omega$, L=5mH, C=0.01μF)



克希荷夫定律

→ **-e(t) + R*i(t) + L*i(t) + ec(t) = 0**

→ **L*i(t) = e(t) - R*i(t) - ec(t)**

C $*$ $\frac{dV_c}{dt}$ = 電容的電流 $=i(t)$ => $C\frac{de_C(t)}{dt}=i(t)$

L $*$ $\frac{dI_l}{dt}$ = 電感的電壓 = $e(t)$ - $R*i(t)$ - $ec(t)$ => $L\frac{di(t)}{dt}=-Ri(t)-e_C(t)+e(t)$

$$\frac{de_C(t)}{dt} = 0 * ec(t) + \frac{1}{C} * i(t) + 0 * e(t)$$

$$\frac{di(t)}{dt} = \frac{-1}{L} * ec(t) + \frac{-R}{L} * i(t) + \frac{1}{L} * e(t)$$

$$\Rightarrow \begin{bmatrix} \frac{de_C(t)}{dt} \\ \frac{di(t)}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{C} \\ -\frac{1}{L} & -\frac{R}{L} \end{bmatrix} \begin{bmatrix} e_C(t) \\ i(t) \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{L} \end{bmatrix} e(t)$$

數值帶入$\Rightarrow \begin{bmatrix} \frac{de_C(t)}{dt} \\ \frac{di(t)}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{1e-8} \\ -\frac{1}{0.005} & -\frac{500}{0.005} \end{bmatrix} \begin{bmatrix} e_C(t) \\ i(t) \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{0.005} \end{bmatrix} e(t)$

若輸入電壓為方波訊號，振幅為±5V，頻率為1KHz，請模擬並繪出電容電壓響應圖、電感電流響應圖以及輸入電壓波形圖。

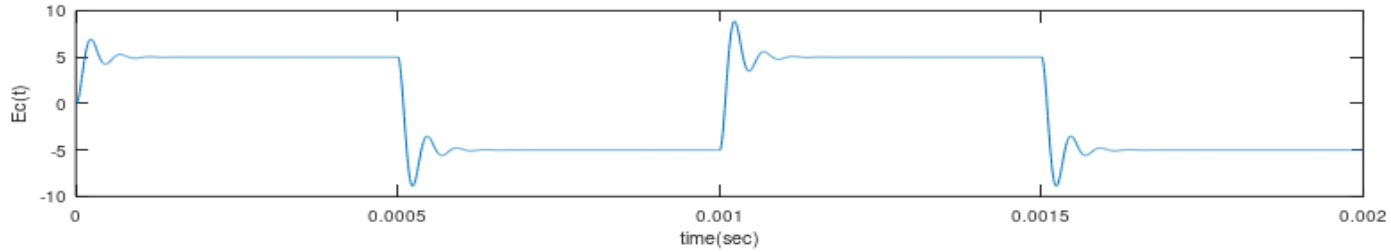
HW03-1

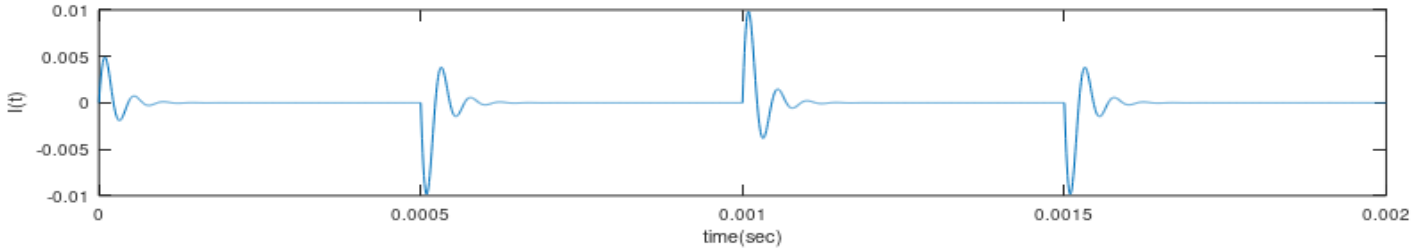
$$C\frac{de_C(t)}{dt}=i(t) \Rightarrow C\Delta V = i(t)\Delta t \Rightarrow de_C(t) = \frac{i(t)dt}{C}$$

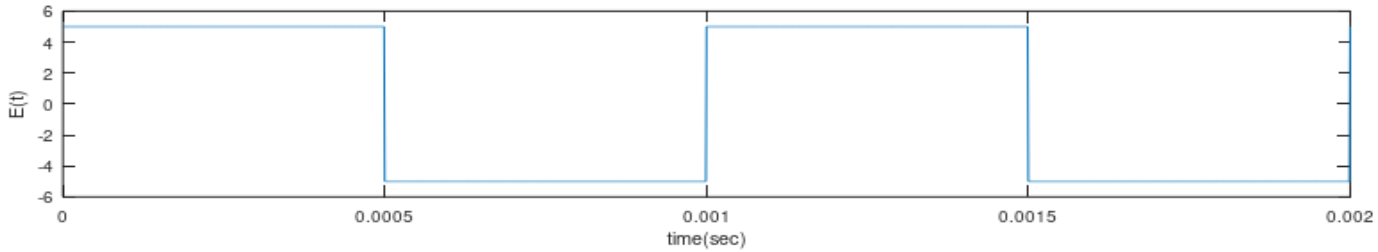
$$L\frac{di(t)}{dt} = -Ri(t) - e_C(t) + e(t) \Rightarrow L\Delta I = (-Ri(t) - e_C(t) + e(t))^* \Delta t \Rightarrow di(t) = \frac{(-Ri(t)-e_C(t)+e(t))^* \mathrm{d}t}{L}$$

下一秒 = 動量 + 前一秒
因此程式如下:

```
Ec(k+1) = (1/C)*I(k)*dt+Ec(k);
I(k+1)=((-1/L)*Ec(k)+(-R/L)*I(k)+(1/L)*E(k))*dt+I(k);
```

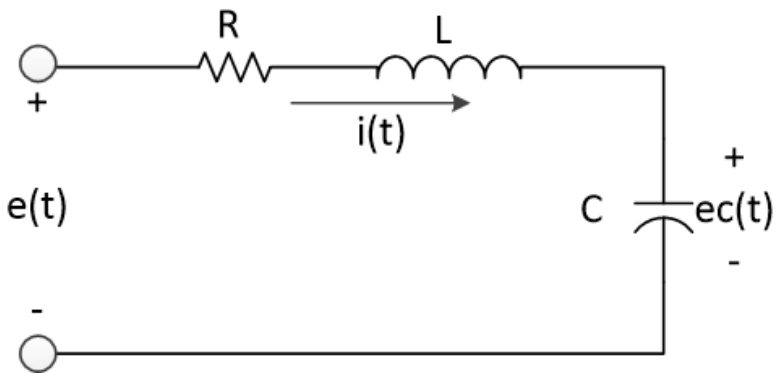






```
$ 1 3.125e-7 12.050203812241895 89 5 43
5e-11
r 64 96 240 96 0 500
w 592 96 464 96 0
l 464 96 240 96 0 0.005
0.0001262782738011 72 0
v 768 336 768 64 0 0 40 5 0 0 0.5
w 64 352 592 352 0
w 592 272 592 352 0
209 592 224 592 272 0 1e-8 -
5.271520004432276 100000 100000
w -80 352 64 352 0
v -192 96 -192 352 0 2 1000 5 0 0 0.5
w -192 96 64 96 0
w -192 352 -80 352 0
w 800 128 800 240 0
w 592 224 592 96 0
c 848 64 848 112 0 1e-8
5.026348428952723 100000
r 880 160 880 224 0 0.1
o 6 8 0 4098 20 0.0015625 0 2 6 3
o 2 8 0 12289 0.0001
0.0089520999012622 68 1 2 2 3
o 8 16 0 4098 10 0.0125 2 2 8 3
38 2 0 0.01 1.01 Inductance
38 0 0 1 101 Resistance
38 6 2 1 100000 Max\sReverse\sVoltage
```

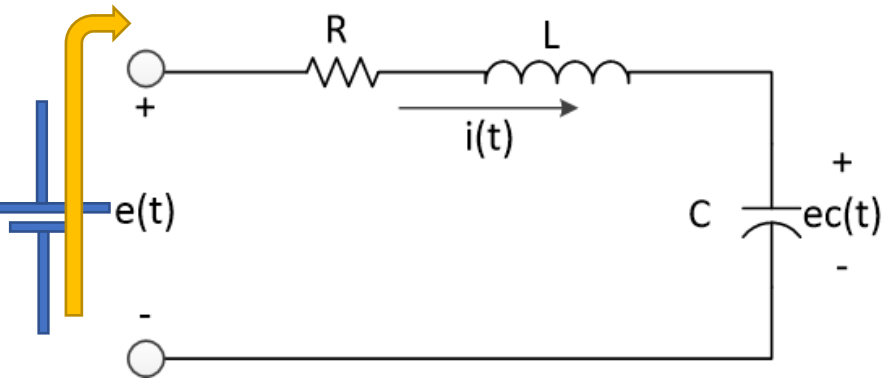
http://www.falstad.com/circuit/circuitjs.html



HW03-2

- 參考左圖，設定兩個狀態，電容電壓$e_C(t)$及電感電流$i(t)$，輸入變數為輸入電壓$e(t)$。
- 請寫出系統狀態方程式(矩陣形式)，(R=0.5$K\Omega$, L=5mH, C=0.01μF)
- 若輸入電壓為正弦波訊號，振幅為±5V，頻率為1KHz，請模擬並繪出電容電壓響應圖、電感電流響應圖以及輸入電壓波形圖。
- 模擬圖說明
- 程式碼以及其註解

請寫出系統狀態方程式(矩陣形式)，(R=0.5$K\Omega$, L=5mH, C=0.01μF)



克希荷夫定律

→ **-e(t) + R*i(t) + L*i(t) + ec(t) = 0**

→ **L*i(t) = e(t) - R*i(t) - ec(t)**

C $*$ $\frac{dV_c}{dt}$ = 電容的電流 $=i(t)$ => $C\frac{de_C(t)}{dt}=i(t)$

L $*$ $\frac{dI_l}{dt}$ = 電感的電壓 = $e(t)$ - $R*i(t)$ - $ec(t)$ => $L\frac{di(t)}{dt}=-Ri(t)-e_C(t)+e(t)$

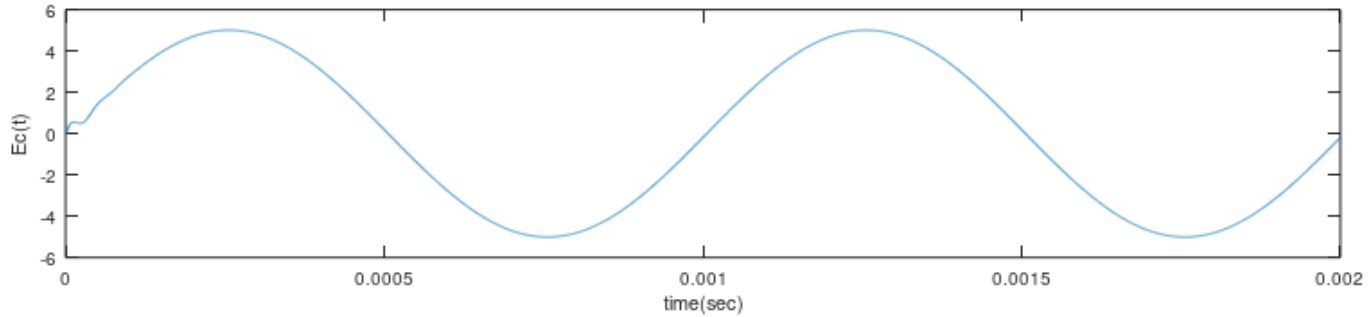
$\frac{de_C(t)}{dt} = 0 * ec(t) + \frac{1}{C} * i(t) + 0 * e(t)$

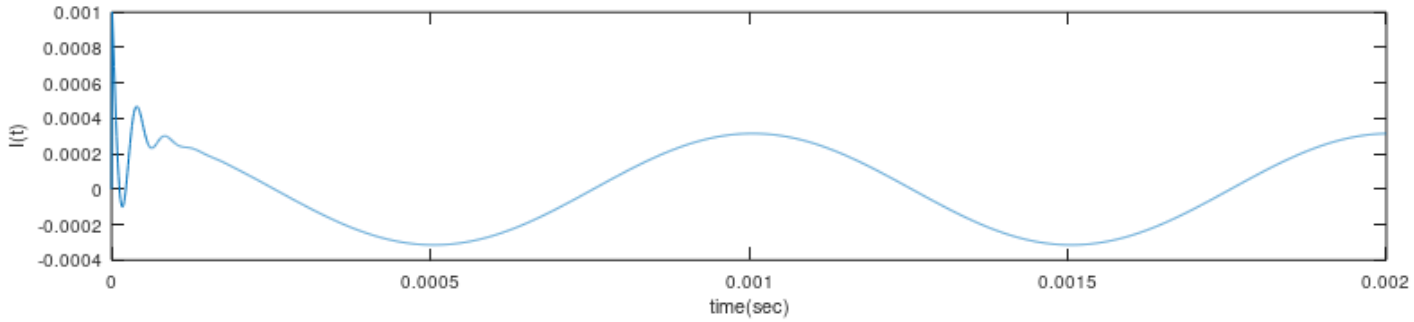
$\frac{di(t)}{dt} = \frac{-1}{L} * ec(t) + \frac{-R}{L} * i(t) + \frac{1}{L} * e(t)$

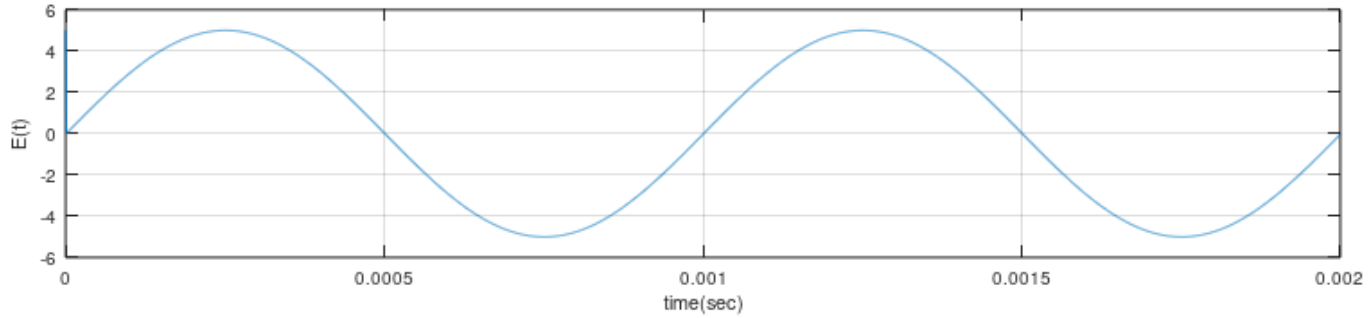
=> $\begin{bmatrix} \frac{de_C(t)}{dt} \\ \frac{di(t)}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{C} \\ -\frac{1}{L} & -\frac{R}{L} \end{bmatrix} \begin{bmatrix} e_C(t) \\ i(t) \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{L} \end{bmatrix} e(t)$

數值帶入=> $\begin{bmatrix} \frac{de_C(t)}{dt} \\ \frac{di(t)}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{1e-8} \\ -\frac{1}{0.005} & -\frac{500}{0.005} \end{bmatrix} \begin{bmatrix} e_C(t) \\ i(t) \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{0.005} \end{bmatrix} e(t)$

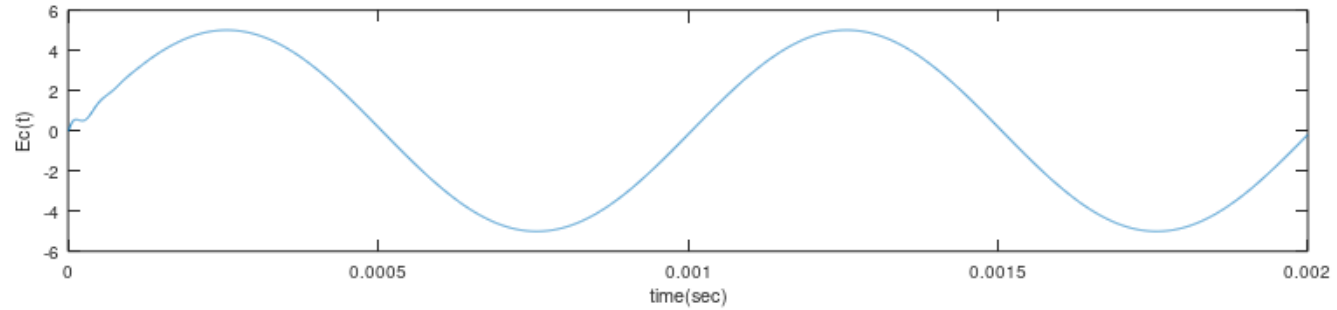
若輸入電壓為正弦波訊號，振幅為$\pm 5V$，頻率為$1KHz$，請模擬並繪出電容電壓響應圖、電感電流響應圖以及輸入電壓波形圖。



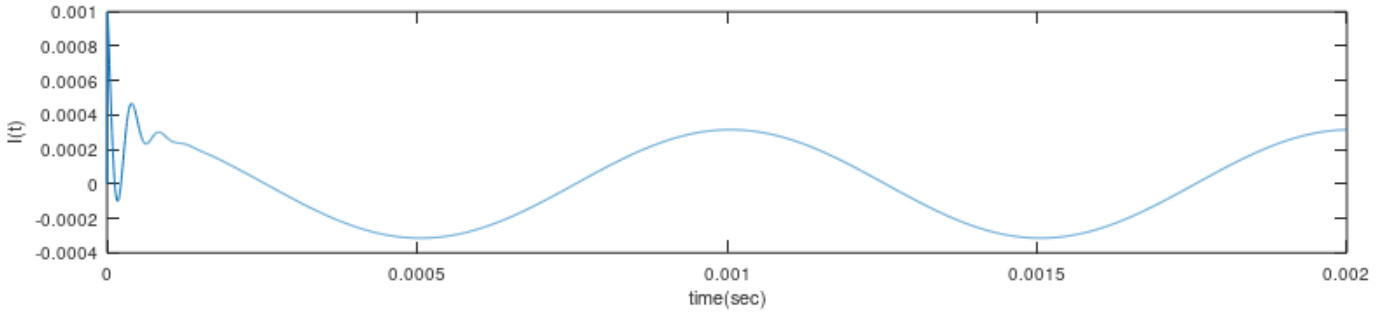




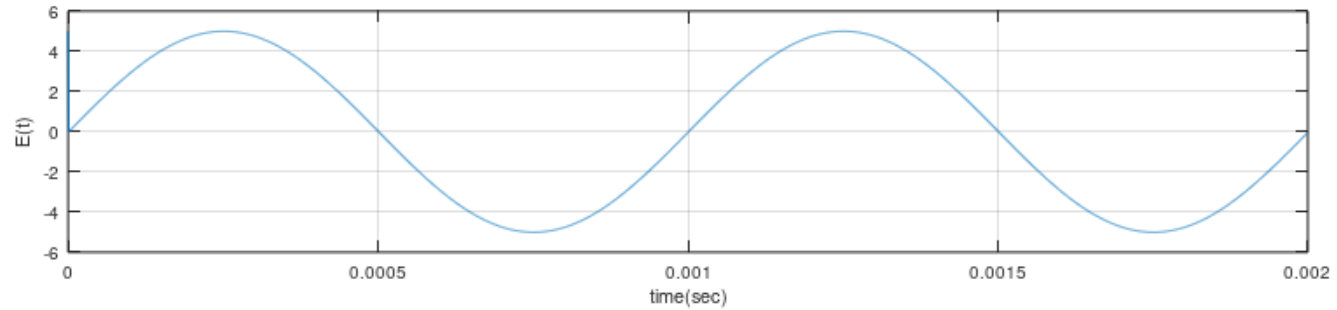
模擬圖說明



電容電壓響應圖



電感電流響應圖



輸入電壓波形圖

週期T = $\frac{1}{f}$ = $\frac{1}{1000}$ = 0.001

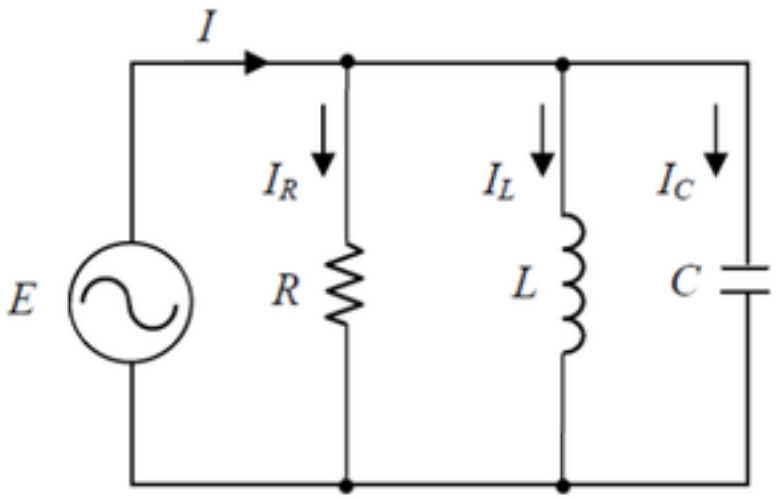
```
clc;clear;close all;
R = 500;
L = 5e-3;
C = 1e-8;

t_s=0;dt=1e-6;t_d=2e-3;
Ec =  zeros(1,2000);%電容電壓
I  = zeros(1,2000);%電感電流
E  = zeros(1,2000);%電源電壓
E(1)=5; % 初始電壓為5V
k=0;
######################
f=1000;%1KHz
######################
for i = t_s:dt:t_d
  k = k+1;
  t(k)=i;

  E(k+1)=5*sin(2*pi*f*t(k));

  %I(k) = (E(k)-Ec(k))/R;
  Ec(k+1) = (1/C)*I(k)*dt+Ec(k);
  I(k+1)=((-1/L)*Ec(k)+(-R/L)*I(k)+(1/L)*E(k))*dt+I(k);
end
```

```
index = length(t);
figure;box on;
subplot(3,1,1);plot(t(1:index),Ec(1:index))
xlabel('time(sec)')
ylabel('Ec(t)')
#axis([0 t_d min(Ec) 1.1 max(Ec) 1.1])
subplot(3,1,2);plot(t(1:index),I(1:index))
xlabel('time(sec)')
ylabel('I(t)')
#axis([0 t_d min(I) 1.1 max(I) 1.1])
subplot(3,1,3);plot(t(1:index),E(1:index))
xlabel('time(sec)')
ylabel('E(t)')
#axis([0 t_d min(E) 1.1 max(E) 1.1])
```

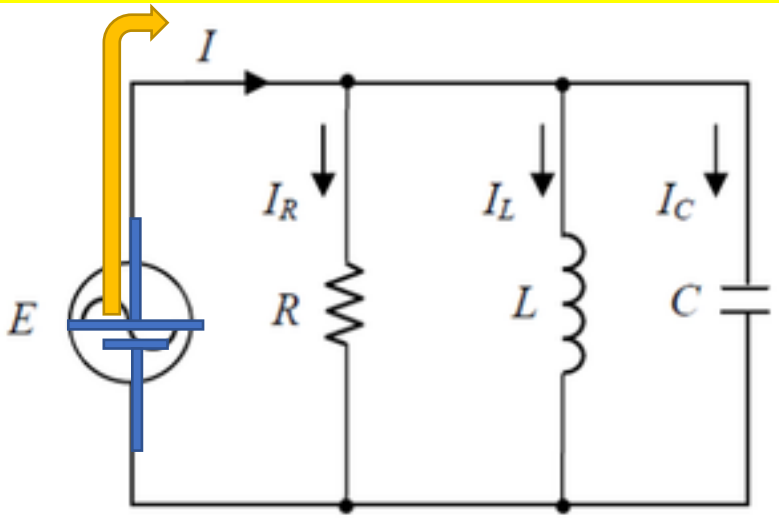
HW03-2

HW03-3

- 參考右圖，設定三個狀態，電容電流$\mathrm{I_C}(t)$，電感電流$\mathrm{I_L}(t)$及電阻電流$\mathrm{I_R}(t)$，一個輸入變數為$\mathrm{E}(t)$。
- 請寫出系統狀態方程式(矩陣形式)，(R=0.5$K\Omega$, L=5mH, C=0.01μF)
- 若輸入電壓為方波訊號，振幅為±5V，頻率為1KHz，請模擬並繪出電容電壓響應圖、電感電流響應圖以及輸入電壓波形圖。
- 模擬圖說明
- 程式碼以及其註解



請寫出系統狀態方程式(矩陣形式)，(R=0.5$K\Omega$, L=5mH, C=0.01μF)



並聯電壓相同

HW03-3

$$I_R = \frac{E(k)}{Rr}$$

$$I_L = \frac{E(k)}{RL}$$

$$I_C = \frac{E(k)}{Rc}$$

C $*$ $\frac{dV_c}{dt}$ = 電容的電流 = E(t) / RC =E(t) / (0.01uF)

L $*$ $\frac{dI_l}{dt}$ = 電感的電壓 = E(t)

$$\frac{de_C(t)}{dt} = \frac{E(t)}{RC} * \frac{1}{c}$$

$$\frac{di(t)}{dt} = \frac{E(t)}{L}$$

$$\Rightarrow \quad \begin{bmatrix} \frac{de_C(t)}{dt} \\ \frac{di(t)}{dt} \end{bmatrix} = \begin{bmatrix} \frac{1}{RC*c} \\ \frac{1}{L} \end{bmatrix} E(t)$$

若輸入電壓為方波訊號，振幅為±5V，頻率為1KHz，請模擬並繪出電容電壓響應圖、電感電流響應圖以及輸入電壓波形圖。

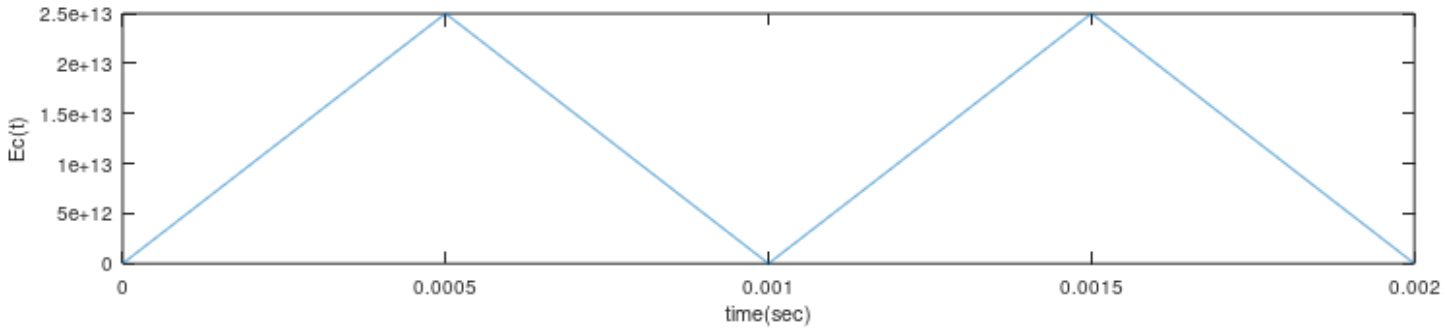
HW03-3

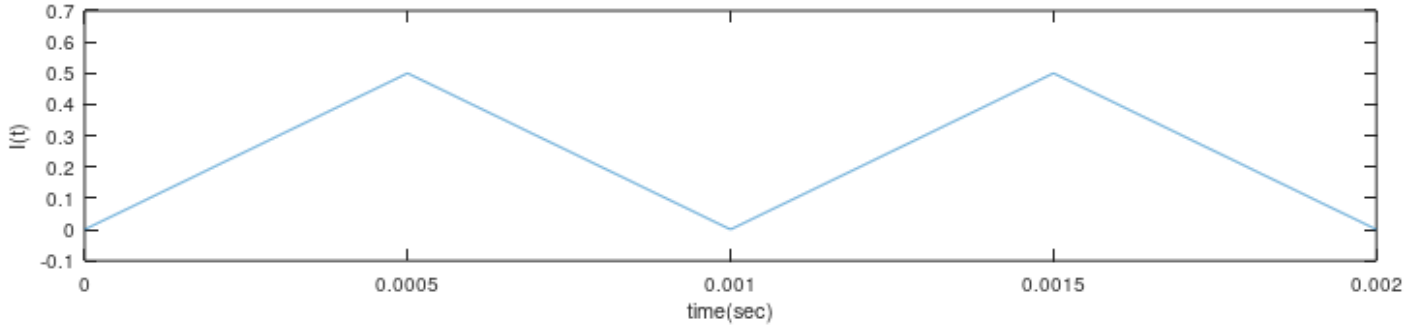
$$\frac{de_C(t)}{dt} = \frac{E(t)}{RC} * \frac{1}{c}$$

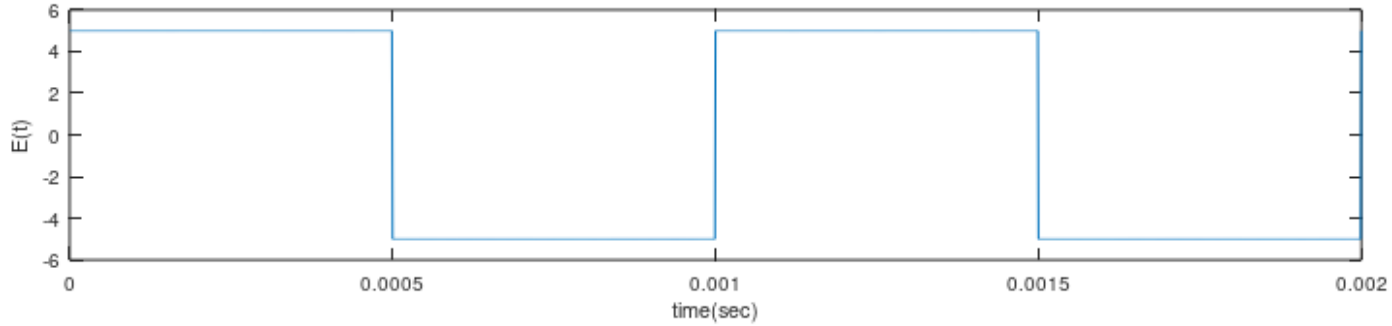
$$\frac{di(t)}{dt} = \frac{E(t)}{RL}$$

下一秒 = 動量 + 前一秒
因此程式如下:

```
Ec(k+1) = (1/C)*(1/C)*E(k)*dt+Ec(k);
I(k+1)=    E(k)*(1/L)*dt+I(k);
```





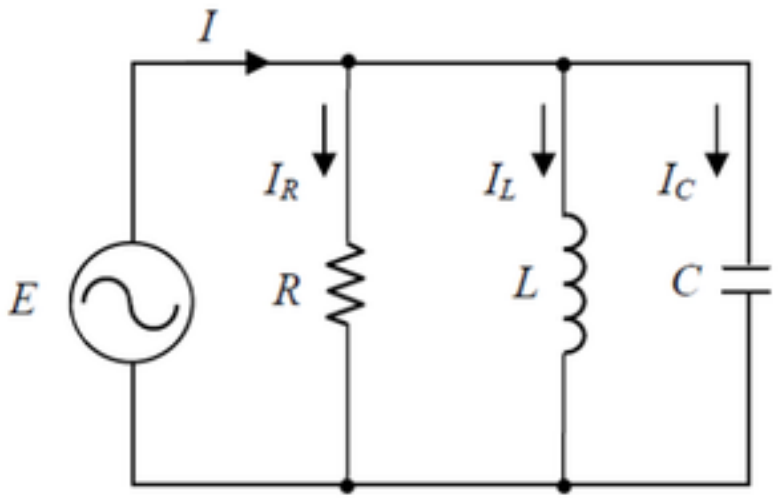


HW03-3

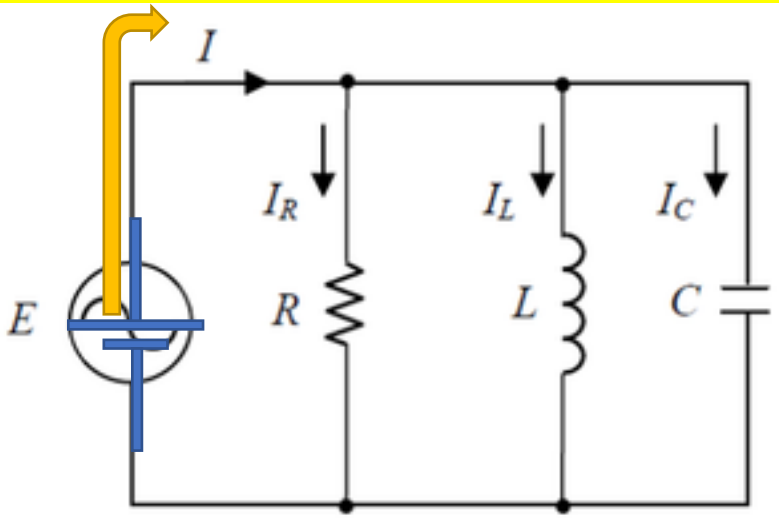
```
clc;clear;close all;
R = 500;
L = 5e-3;
C = 1e-8;

t_s=0;dt=1e-6;t_d=2e-3;
Ec =  zeros(1,2000);%電容電壓
I  = zeros(1,2000);%電感電流
E  = zeros(1,2000);%電源電壓
E(1)=5; % 初始電壓為5V
k=0;
for i = t_s:dt:t_d
  k = k+1;
  t(k)=i;

  if mod(k,500)==0
    E(k+1)=-E(k);
  else
    E(k+1)=E(k);
  end

  Ec(k+1) = (1/C)*(1/C)*E(k)*dt+Ec(k);
  I(k+1)=    E(k)*(1/L)*dt+I(k);
end
index = length(t);
figure;box on;
subplot(3,1,1);plot(t(1:index),Ec(1:index))
xlabel('time(sec)')
ylabel('Ec(t)')
#axis([0 t_d min(Ec) 1.1 max(Ec) 1.1])
subplot(3,1,2);plot(t(1:index),I(1:index))
xlabel('time(sec)')
ylabel('I(t)')
#axis([0 t_d min(I) 1.1 max(I) 1.1])
subplot(3,1,3);plot(t(1:index),E(1:index))
xlabel('time(sec)')
ylabel('E(t)')
#axis([0 t_d min(E) 1.1 max(E) 1.1])
```

HW03-4

- 參考右圖，設定三個狀態，電容電流$I_C(t)$，電感電流$I_L(t)$及電阻電流$I_R(t)$，一個輸入變數為$E(t)$。
- 請寫出系統狀態方程式(矩陣形式)，(R=0.5$K\Omega$, L=5mH, C=0.01μF)
- 若輸入電壓為正弦波訊號，振幅為±5V，頻率為1KHz，請模擬並繪出電容電壓響應圖、電感電流響應圖以及輸入電壓波形圖。
- 模擬圖說明
- 程式碼以及其註解



請寫出系統狀態方程式(矩陣形式)，(R=0.5$K\Omega$, L=5mH, C=0.01μF)



並聯電壓相同

HW03-3

$$I_R = \frac{E(k)}{Rr}$$

$$I_L = \frac{E(k)}{RL}$$

$$I_C = \frac{E(k)}{Rc}$$

C $*$ $\frac{dV_c}{dt}$ = 電容的電流 = E(t) / RC =E(t) / (0.01uF)

L $*$ $\frac{dI_l}{dt}$ = 電感的電壓 = E(t)

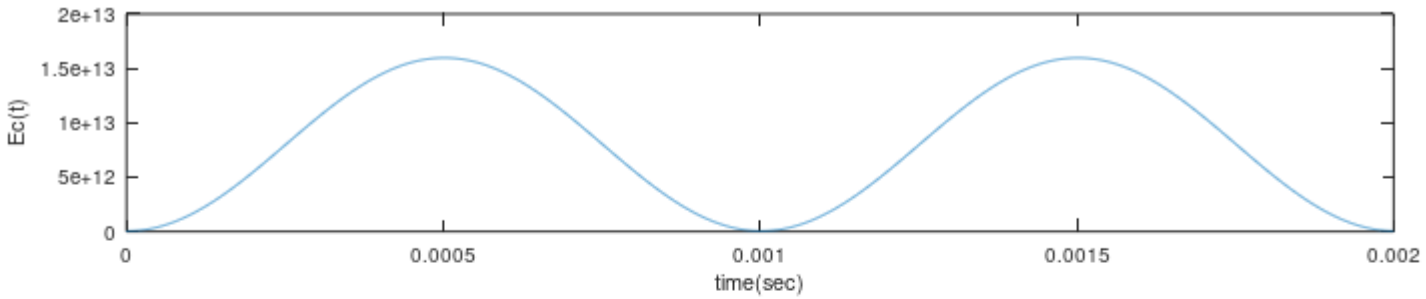
$$\frac{de_C(t)}{dt} = \frac{E(t)}{RC} * \frac{1}{c}$$

$$\frac{di(t)}{dt} = \frac{E(t)}{RL}$$

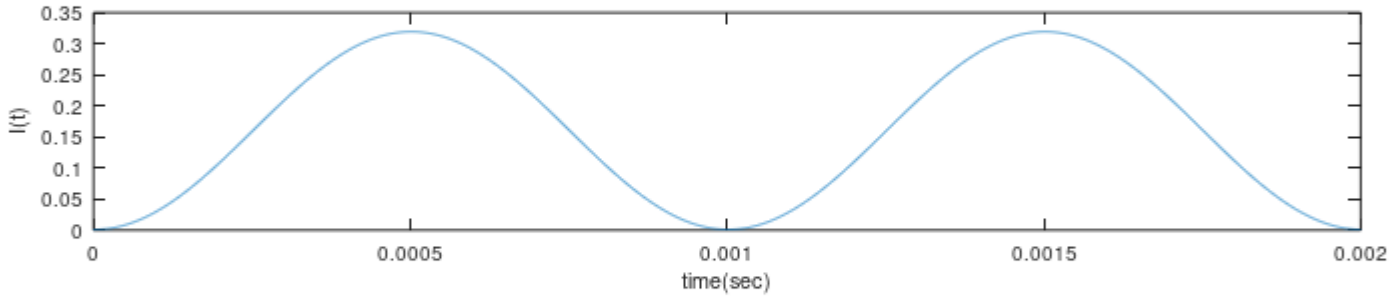
$$\Rightarrow \quad \begin{bmatrix} \frac{de_C(t)}{dt} \\ \frac{di(t)}{dt} \end{bmatrix} = \begin{bmatrix} \frac{1}{RC*c} \\ \frac{1}{L} \end{bmatrix} E(t)$$

若輸入電壓為正弦波訊號，振幅為$\pm 5V$，頻率為$1KHz$，請模擬並繪出電容電壓響應圖、電感電流響應圖以及輸入電壓波形圖。

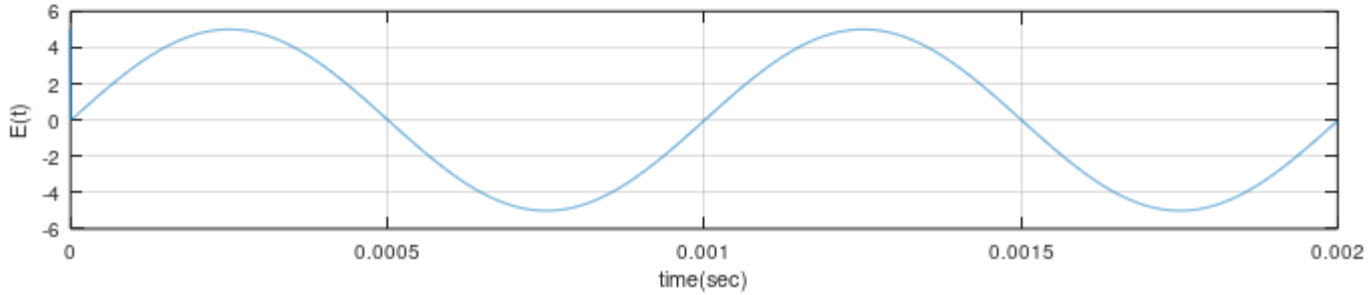
HW03-4



電容電壓響應圖



電感電流響應圖



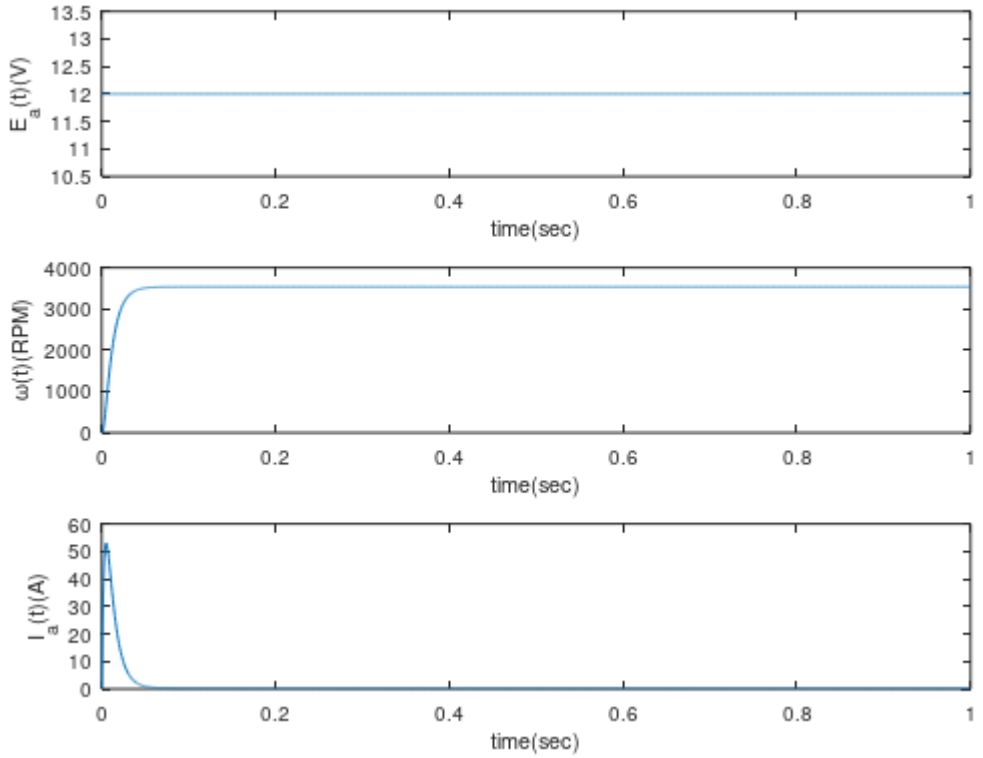
輸入電壓波形圖

```
clc;clear;close all;
R = 500;
L = 5e-3;
C = 1e-8;

t_s=0;dt=1e-6;t_d=2e-3;
Ec =  zeros(1,2000);%電容電壓
I  = zeros(1,2000);%電感電流
E  = zeros(1,2000);%電源電壓
E(1)=5; % 初始電壓為5V
k=0;
######################
f=1000;%1KHz
######################
for i = t_s:dt:t_d
  k = k+1;
  t(k)=i;

  E(k+1)=5*sin(2*pi*f*t(k));

  Ec(k+1) = (1/C)*(1/C)*E(k)*dt+Ec(k);
  I(k+1)=    E(k)*(1/L)*dt+I(k);
end
```

```
index = length(t);
figure;box on;                                          HW03-4
subplot(3,1,1);plot(t(1:index),Ec(1:index))
xlabel('time(sec)')
ylabel('Ec(t)')
#axis([0 t_d min(Ec) 1.1 max(Ec) 1.1])
subplot(3,1,2);plot(t(1:index),I(1:index))
xlabel('time(sec)')
ylabel('I(t)')
#axis([0 t_d min(I) 1.1 max(I) 1.1])
subplot(3,1,3);plot(t(1:index),E(1:index))
xlabel('time(sec)')
ylabel('E(t)')
#axis([0 t_d min(E) 1.1 max(E) 1.1])
```

直流馬達模擬參數

$$J_m = 7.5 * 10^{-5}$$
$$B_m = 2 * 10^{-5}$$
$$K_i = K_e = 0.0323$$
$$R_a = 0.19$$
$$L_a = 5 * 10^{-4}$$



HW03-5

- PMDC Motor之參數如左。
- 請完成以下模擬(模擬時間1sec)

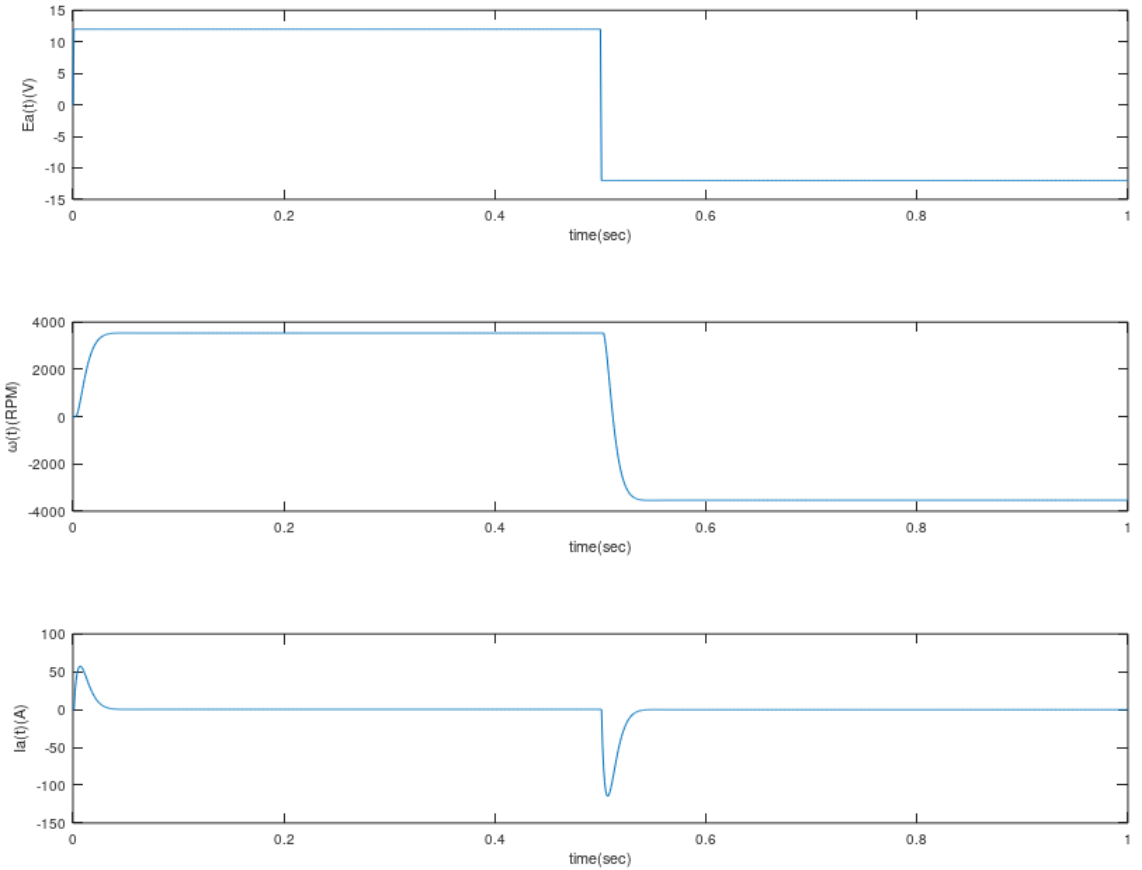
(1) Ea=12, t<0.5; Ea=-12 t>=0.5
(2) 振幅10，正弦波, 頻率為5Hz
(3) 振幅5，方波, 頻率為5Hz

模擬圖如左，由上至下依序為輸入電壓，角速度，電流。角速度之單位須為RPM

(1) Ea=12, t<0.5; Ea=-12 t>=0.5

```
clc;clear;close all;
Jm = 7.5e-5;
Bm = 2e-5;
Ki = 0.0323;
Ke = 0.0323;
Kb = 0.0323;
Ra = 0.19;
La = 5e-4;

t_s=0;dt=1e-3;t_d=1;
ea =  zeros(1,2000);
eb =  zeros(1,2000);
Wm  = zeros(1,2000);
ia  = zeros(1,2000);
theta  = zeros(1,2000);
k=0;
```

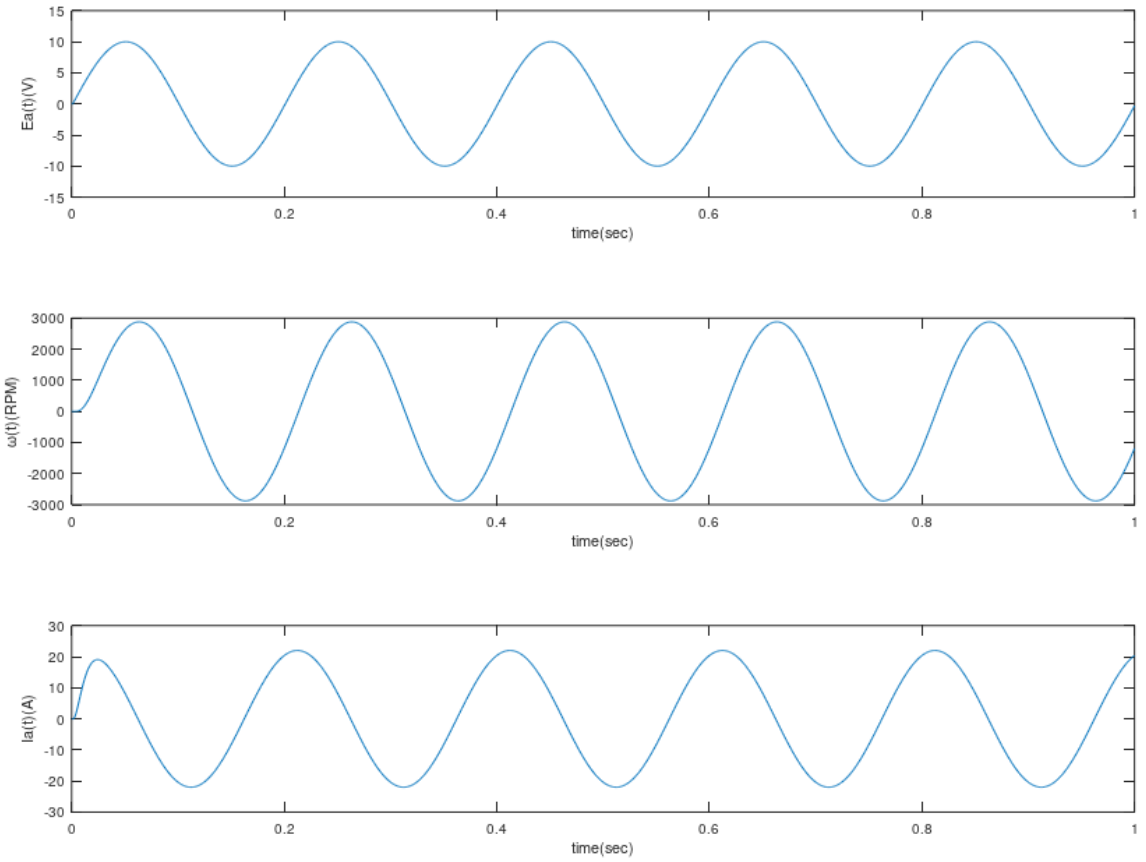
```
for t=t_s:dt:t_d
  k=k+1;
  T(k)=t;
  if t<0.5
     ea(k+1)=12;
  else
     ea(k+1)=-12;
  endif
  TL(k)=0;
  Tm(k+1)=Ki*ia(k);
  Wm(k+1)=(Tm(k)-TL(k)-Bm*Wm(k))/Jm*dt+Wm(k);
  eb(k+1)=Kb*Wm(k);
  ia(k+1)=(ea(k)-Ra*ia(k)-eb(k))/La*dt+ia(k);
  theta(k+1)=Wm(k)*dt+theta(k);

endfor
index = length(T);
figure;box on;
subplot(3,1,1);plot(T(1:index),ea(1:index))
xlabel('time(sec)')
ylabel('Ea(t)(V)')
axis([0 1 -15 15])#axis([xmin xmax ymin ymax])
#axis([0 t_d min(Ec) 1.1 max(Ec) 1.1])
subplot(3,1,2);plot(T(1:index),Wm(1:index)*(60/(2*
pi)))
xlabel('time(sec)')
ylabel('\omega(t)(RPM)')
#axis([0 t_d min(I) 1.1 max(I) 1.1])
subplot(3,1,3);plot(T(1:index),ia(1:index))
xlabel('time(sec)')
ylabel('Ia(t)(A)')
#axis([0 t_d min(E) 1.1 max(E) 1.1])
```



(2)振幅10，正弦波，頻率為5Hz


```
clc;clear;close all;
Jm = 7.5e-5;
Bm = 2e-5;
Ki = 0.0323;
Ke = 0.0323;
Kb = 0.0323;
Ra = 0.19;
La = 5e-4;

t_s=0;dt=1e-3;t_d=1;
ea =  zeros(1,2000);
eb =  zeros(1,2000);
Wm  = zeros(1,2000);
ia  = zeros(1,2000);
theta  = zeros(1,2000);
k=0;
####################
f=5;%1KHz
####################
```

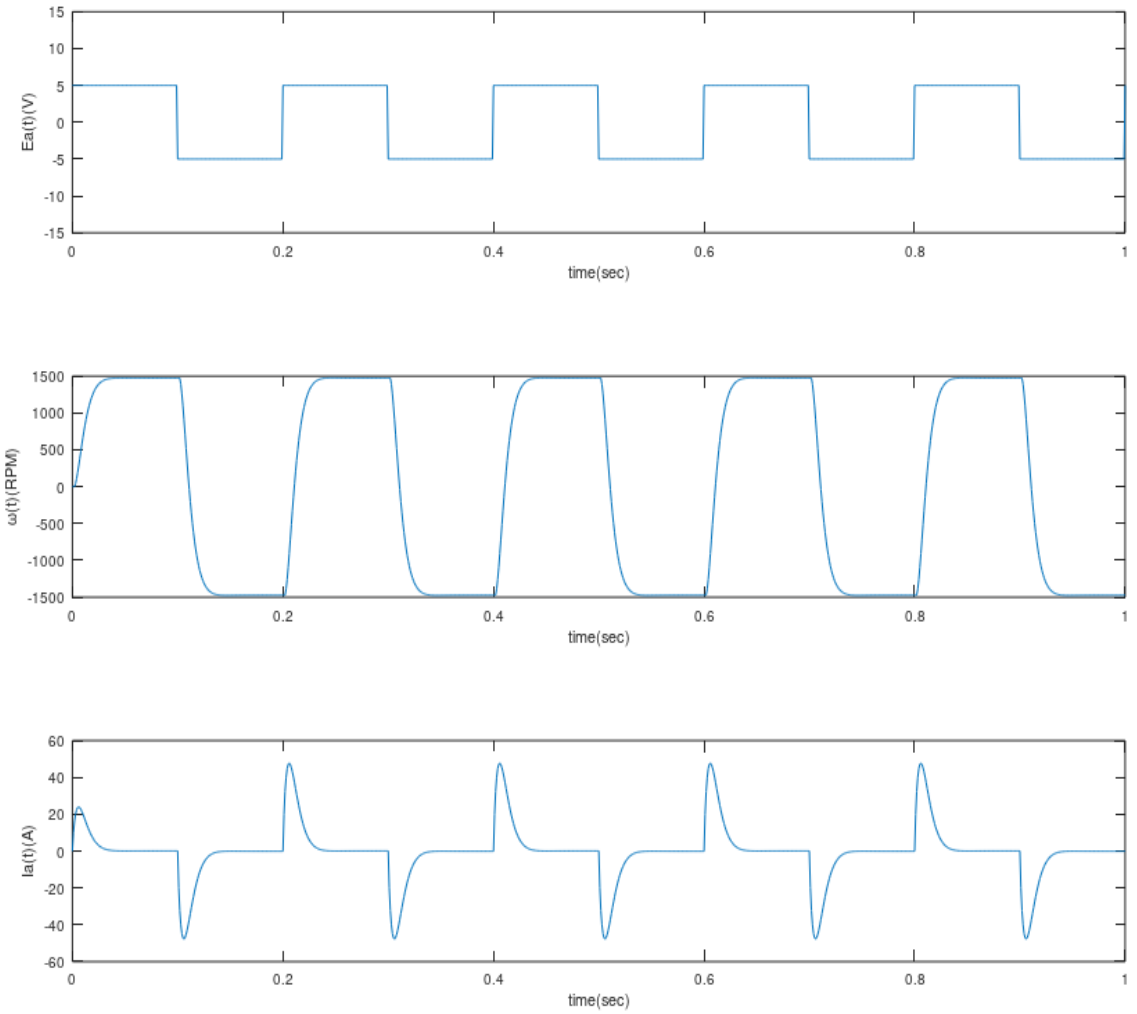
```
for i=t_s:dt:t_d
  k=k+1;
  T(k)=i;

  ea(k+1)=10*sin(2*pi*f*T(k));

  TL(k)=0;
  Tm(k+1)=Ki*ia(k);
  Wm(k+1)=(Tm(k)-TL(k)-Bm*Wm(k))/Jm*dt+Wm(k);
  eb(k+1)=Kb*Wm(k);
  ia(k+1)=(ea(k)-Ra*ia(k)-eb(k))/La*dt+ia(k);
  theta(k+1)=Wm(k)*dt+theta(k);

endfor
index = length(T);
figure;box on;
subplot(3,1,1);plot(T(1:index),ea(1:index))
xlabel('time(sec)')
ylabel('Ea(t)(V)')
axis([0 1 -15 15])#axis([xmin xmax ymin ymax])
#axis([0 t_d min(Ec) 1.1 max(Ec) 1.1])
subplot(3,1,2);plot(T(1:index),Wm(1:index)*(60/(2*
pi)))
xlabel('time(sec)')
ylabel('\omega(t)(RPM)')
#axis([0 t_d min(I) 1.1 max(I) 1.1])
subplot(3,1,3);plot(T(1:index),ia(1:index))
xlabel('time(sec)')
ylabel('Ia(t)(A)')
#axis([0 t_d min(E) 1.1 max(E) 1.1])
```



(3)振幅5，方波，頻率為5Hz

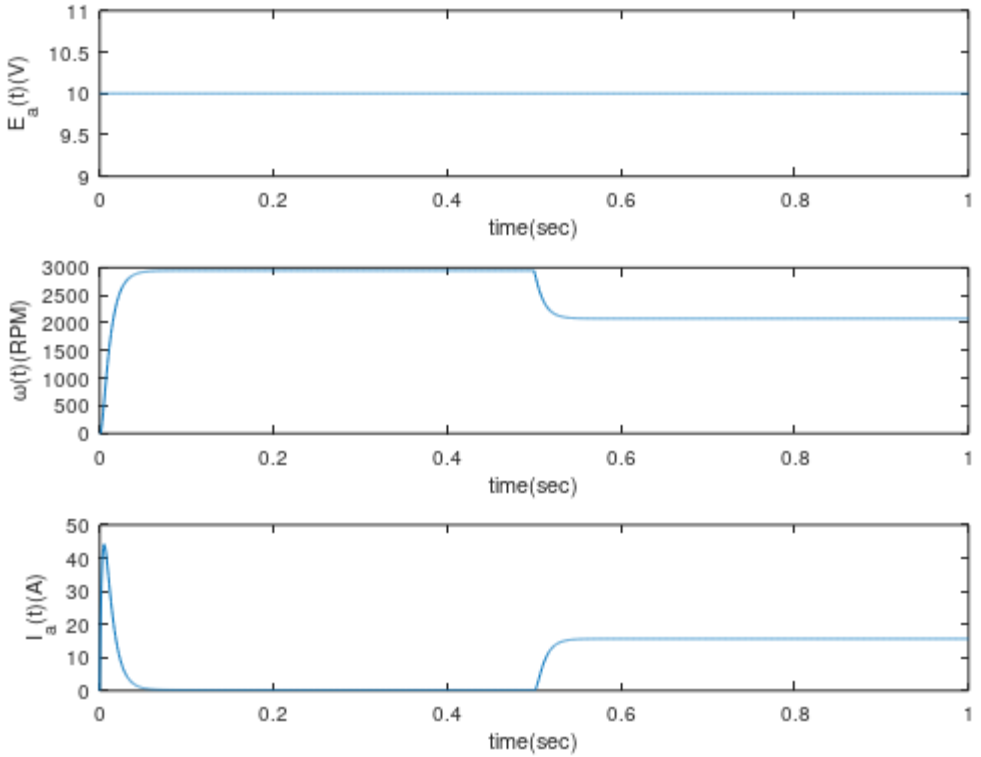

```
clc;clear;close all;
Jm = 7.5e-5;
Bm = 2e-5;
Ki = 0.0323;
Ke = 0.0323;
Kb = 0.0323;
Ra = 0.19;
La = 5e-4;

t_s=0;dt=1e-3;t_d=1;
ea =  zeros(1,2000);
eb =  zeros(1,2000);
Wm  = zeros(1,2000);
ia  = zeros(1,2000);
theta  = zeros(1,2000);
k=0;
ea(1)=5;
```

```
for t=t_s:dt:t_d
  k=k+1;
  T(k)=t;
  %輸入電壓(方波)
  %方波頻率為5Hz，表示週期為T=0.2(sec)
  %即每T=0.1(sec)，訊號需轉態H->L or L->H
  %若考慮取樣時間設定為0.001
  %則k變數每計數100，E變數需轉態
  if mod(k,100)==0
    ea(k+1)=-ea(k);
  else
    ea(k+1)=ea(k);
  endif
  TL(k)=0;
  Tm(k+1)=Ki*ia(k);
  Wm(k+1)=(Tm(k)-TL(k)-Bm*Wm(k))/Jm*dt+Wm(k);
  eb(k+1)=Kb*Wm(k);
  ia(k+1)=(ea(k)-Ra*ia(k)-eb(k))/La*dt+ia(k);
  theta(k+1)=Wm(k)*dt+theta(k);
endfor
index = length(T);
figure;box on;
subplot(3,1,1);plot(T(1:index),ea(1:index))
xlabel('time(sec)')
ylabel('Ea(t)(V)')
axis([0 1 -15 15])#axis([xmin xmax ymin ymax])
#axis([0 t_d min(Ec) 1.1 max(Ec) 1.1])
subplot(3,1,2);plot(T(1:index),Wm(1:index)*(60/(2*pi)))
xlabel('time(sec)')
ylabel('\omega(t)(RPM)')
subplot(3,1,3);plot(T(1:index),ia(1:index))
xlabel('time(sec)')
ylabel('Ia(t)(A)')
```



直流馬達模擬參數

$$J_m = 7.5 * 10^{-5}$$
$$B_m = 2 * 10^{-5}$$
$$K_i = K_e = 0.0323$$
$$R_a = 0.19$$
$$L_a = 5 * 10^{-4}$$



HW03-6

- PMDC Motor之參數如左。
- 請完成以下模擬(模擬時間1sec)

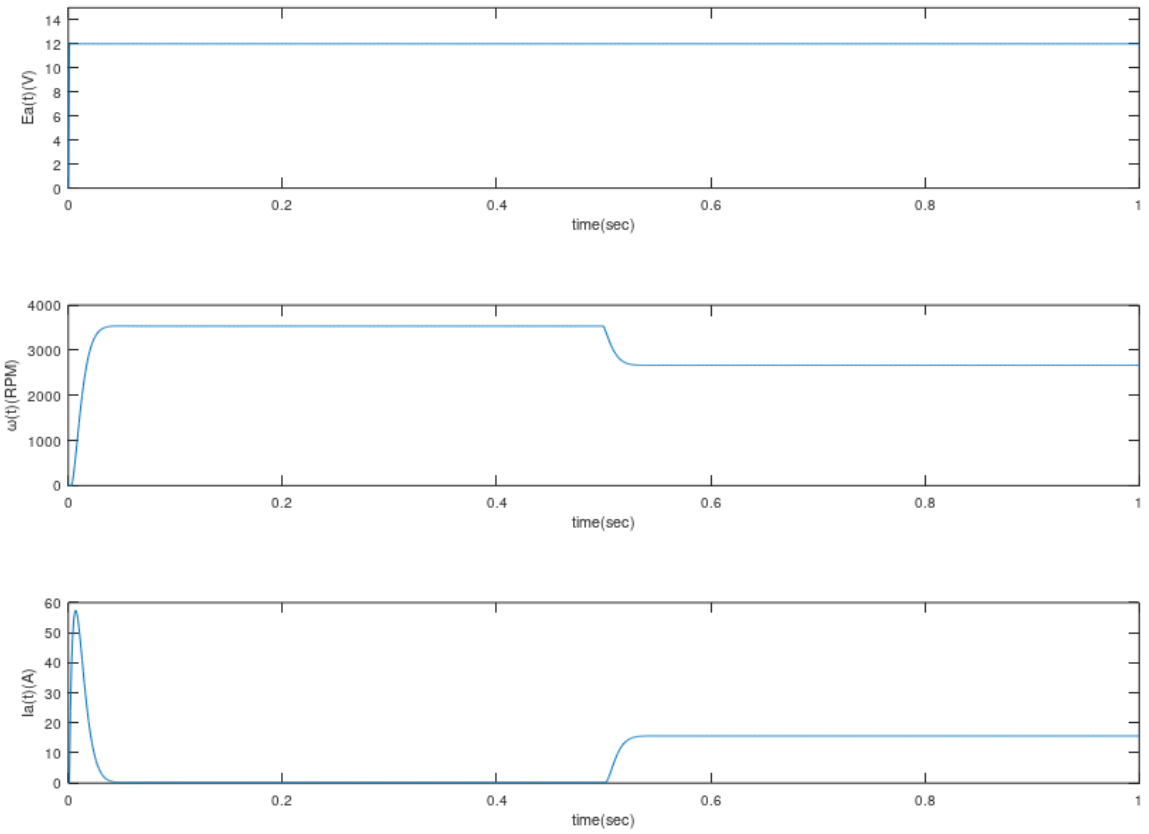
(1) Ea=12，TL=0, t<0.5; TL=0.5, t>0.5

模擬圖如左，由上至下依序為輸入電壓，角速度，電流。角速度之單位須為RPM

(1) Ea=12，TL=0, t<0.5; TL=0.5, t>0.5

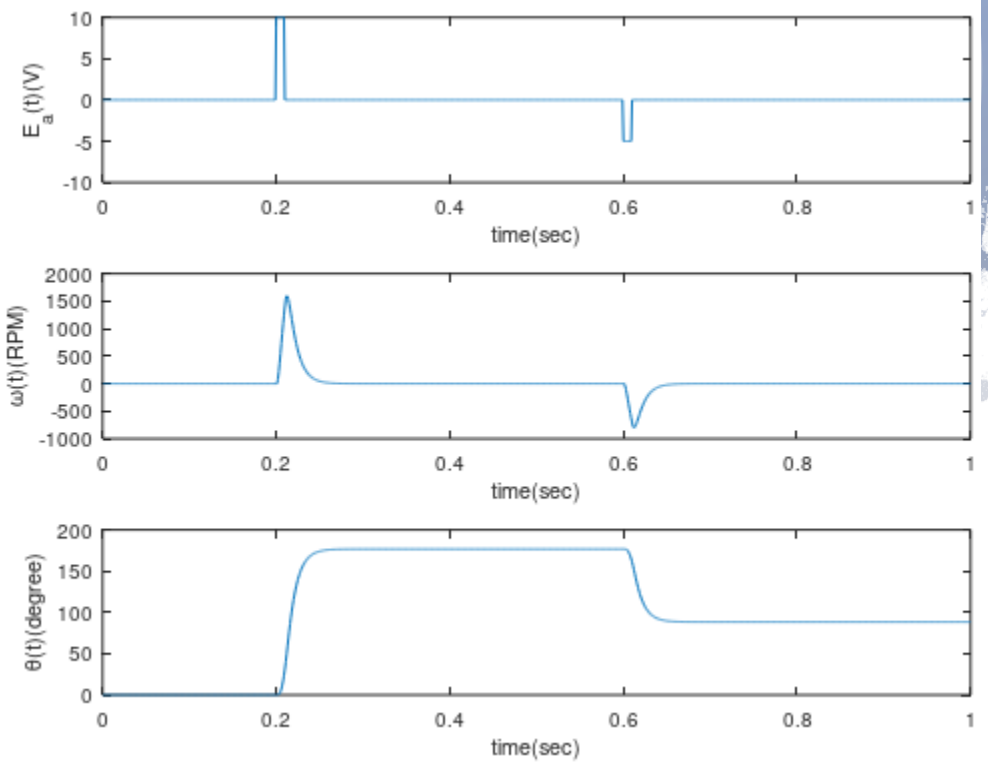

```
clc;clear;close all;
Jm = 7.5e-5;
Bm = 2e-5;
Ki = 0.0323;
Ke = 0.0323;
Kb = 0.0323;
Ra = 0.19;
La = 5e-4;

t_s=0;dt=1e-3;t_d=1;
ea =  zeros(1,2000);
eb =  zeros(1,2000);
Wm  = zeros(1,2000);
ia  = zeros(1,2000);
theta  = zeros(1,2000);
k=0;
```

```
for t=t_s:dt:t_d
  k=k+1;
  T(k)=t;
  if t<0.5
     ea(k+1)=12;
     TL(k)=0;
  else
     ea(k+1)=12;
     TL(k)=0.5;
  endif
  Tm(k+1)=Ki*ia(k);
  Wm(k+1)=(Tm(k)-TL(k)-Bm*Wm(k))/Jm*dt+Wm(k);
  eb(k+1)=Kb*Wm(k);
  ia(k+1)=(ea(k)-Ra*ia(k)-eb(k))/La*dt+ia(k);
  theta(k+1)=Wm(k)*dt+theta(k);

endfor
index = length(T);
figure;box on;
subplot(3,1,1);plot(T(1:index),ea(1:index))
xlabel('time(sec)')
ylabel('Ea(t)(V)')
axis([0 1 0 15])#axis([xmin xmax ymin ymax])
#axis([0 t_d min(Ec) 1.1 max(Ec) 1.1])
subplot(3,1,2);plot(T(1:index),Wm(1:index)*(60/(2*
pi)))
xlabel('time(sec)')
ylabel('\omega(t)(RPM)')
#axis([0 t_d min(I) 1.1 max(I) 1.1])
subplot(3,1,3);plot(T(1:index),ia(1:index))
xlabel('time(sec)')
ylabel('Ia(t)(A)')
#axis([0 t_d min(E) 1.1 max(E) 1.1])
```



直流馬達模擬參數

$$J_m = 7.5 * 10^{-5}$$
$$B_m = 2 * 10^{-5}$$
$$K_i = K_e = 0.0323$$
$$R_a = 0.19$$
$$L_a = 5 * 10^{-4}$$



HW03-7

- PMDC Motor之參數如左。
- 請完成以下模擬(模擬時間1sec)

$$\begin{cases} E_a = 0, & t \le 0.2 \\ E_a = 10, & 0.2 < t \le 0.21 \\ E_a = 0, & 0.21 < t \le 0.6 \\ E_a = -5, & 0.6 < t \le 0.61 \\ E_a = 0, & 0.61 < t \end{cases}$$

模擬圖如左，由上至下依序為輸入電壓，角速度，角度。角速度之單位須為RPM，角度之單位為(度)

HW03-7

```
clc;clear;close all;
Jm = 7.5e-5;
Bm = 2e-5;
Ki = 0.0323;
Ke = 0.0323;
Kb = 0.0323;
Ra = 0.19;
La = 5e-4;

t_s=0;dt=1e-3;t_d=1;
ea =  zeros(1,2000);
eb =  zeros(1,2000);
Wm  = zeros(1,2000);
ia  = zeros(1,2000);
theta  = zeros(1,2000);
k=0;
```

```
for t=t_s:dt:t_d
  k=k+1;
  T(k)=t;
  if t<0.2
     ea(k+1)=0;
  elseif t<0.21
     ea(k+1)=10;
  elseif t<0.6
     ea(k+1)=0;
  elseif t<0.61
     ea(k+1)=-5;
  else
     ea(k+1)=0;
  endif
  TL(k)=0;
  Tm(k+1)=Ki*ia(k);
  Wm(k+1)=(Tm(k)-TL(k)-Bm*Wm(k))/Jm*dt+Wm(k);
  eb(k+1)=Kb*Wm(k);
  ia(k+1)=(ea(k)-Ra*ia(k)-eb(k))/La*dt+ia(k);
  theta(k+1)=Wm(k)*dt+theta(k);

endfor
index = length(T);
figure;box on;
subplot(3,1,1);plot(T(1:index),ea(1:index))
xlabel('time(sec)')
ylabel('Ea(t)(V)')
#axis([0 t_d min(Ec) 1.1 max(Ec) 1.1])
subplot(3,1,2);plot(T(1:index),Wm(1:index)*(60/(2*pi)))
xlabel('time(sec)')
ylabel('\omega(t)(RPM)')
#axis([0 t_d min(I) 1.1 max(I) 1.1])
subplot(3,1,3);plot(T(1:index),theta(1:index)*(180/pi))
xlabel('time(sec)')
ylabel('\theta(t)degree')
#axis([0 t_d min(E) 1.1 max(E) 1.1])
```