MATLAB 教學講義

Advanced Intelligent Robot and
System Lab, EE, NCKU

Matlab 基本功能介紹

Matlab 爲一高品質之數值計算及圖形顯示軟體,其整合了

- 數值分析
- 矩陣運算
- 信號處理
- 圖形顯示

等功能於一體,而提供了各種工程分析與設計之能力.

Reference Book： Matlab 程式設計與應用 張智星 清蔚科技
MATLAB 6.X 與基礎自動控制 松崗出版社

Matlab 基本設計

- 直接在 command window 下一行行執行的 Script M-file
  - 所需的變數直接從 workspace 中去獲得並建立
  - 不需輸入輸出引述的呼叫
  - 無法保留

- 可存取的 M file
  - 開啓方法
    - File -> New -> M-file
    - New M-file
  - 以 Editor/Debugger 撰寫程式

Command window instruction

- 多項式之表示法及運算：

  MATLAB使用列向量(row vector)來表示一個多項式,例如： $p(x) = x^3 - 2x + 5$ 表示爲 p = [1 0 -2 5];

- 指令roots： r = roots(p)

```
r = -2.0946
    1.0473+1.1359i
    1.0473 -1.1359i
```

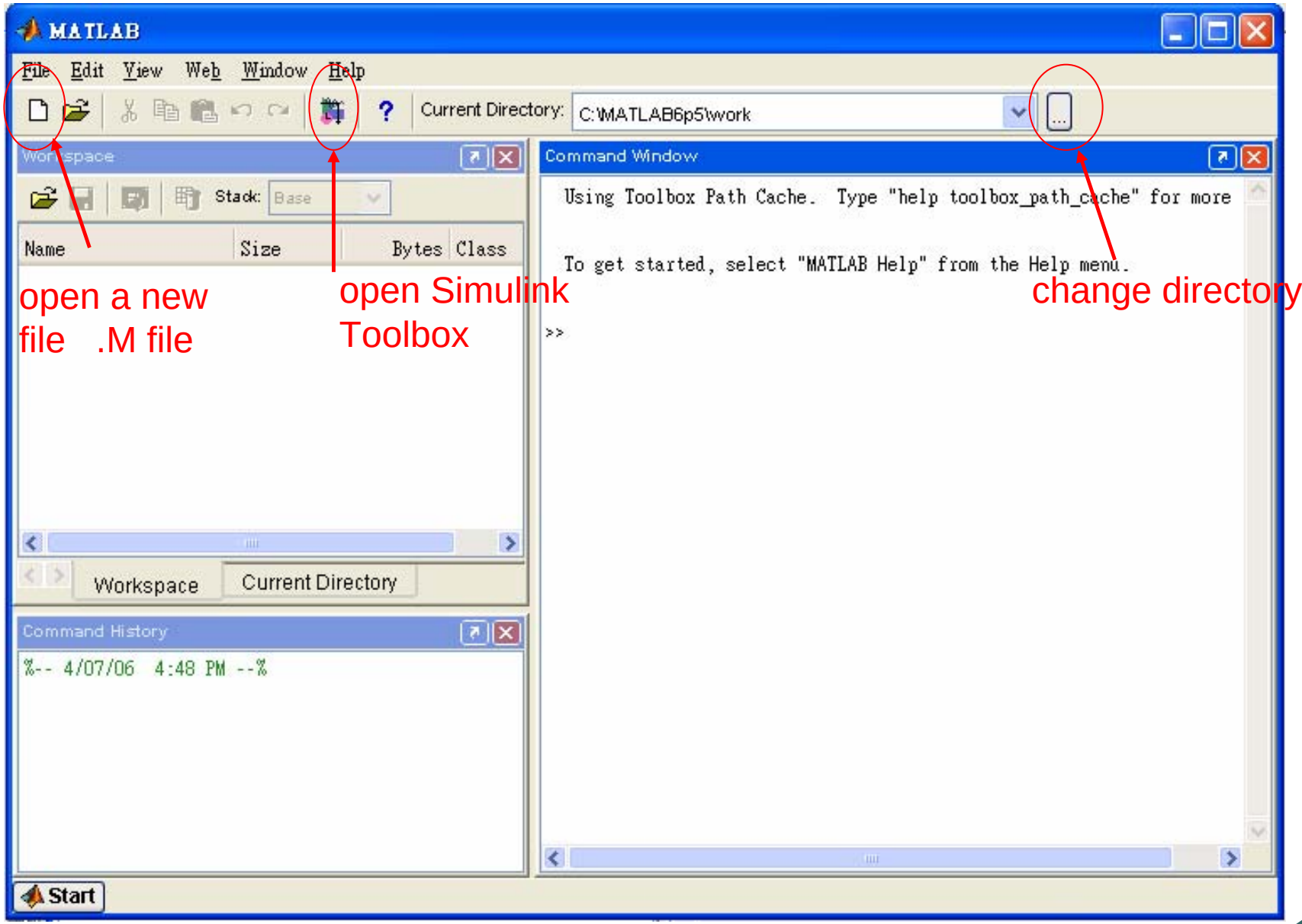
- 指令poly：p1 = poly(r)

```
p1= 1.0000    0.0000   -2.0000    5.0000
```

Command window instruction

- inv指令

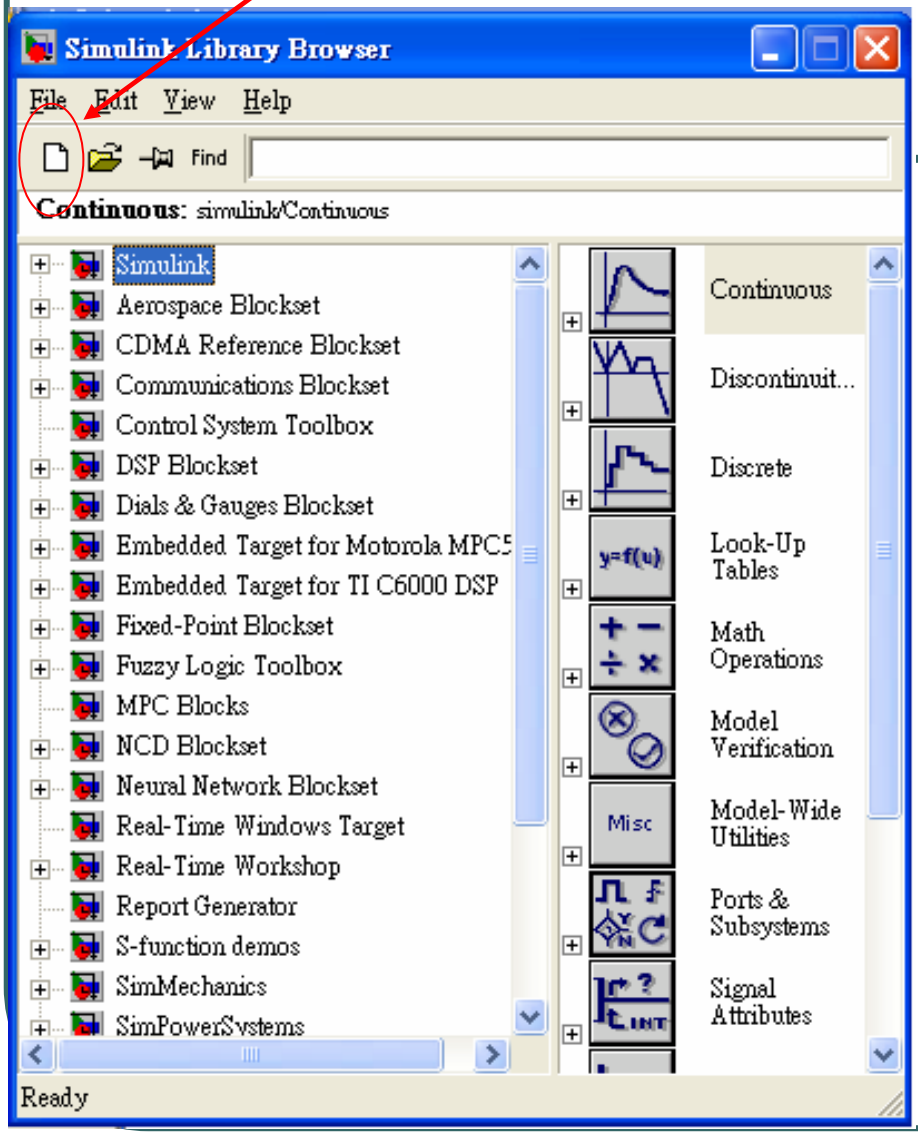
```
A= [1 2 3 ; 4 5 6 ; 7 8 0];
inv(A)

ans =

   -1.7778    0.8889   -0.1111
    1.5556   -0.7778    0.2222
   -0.1111    0.2222   -0.1111
```

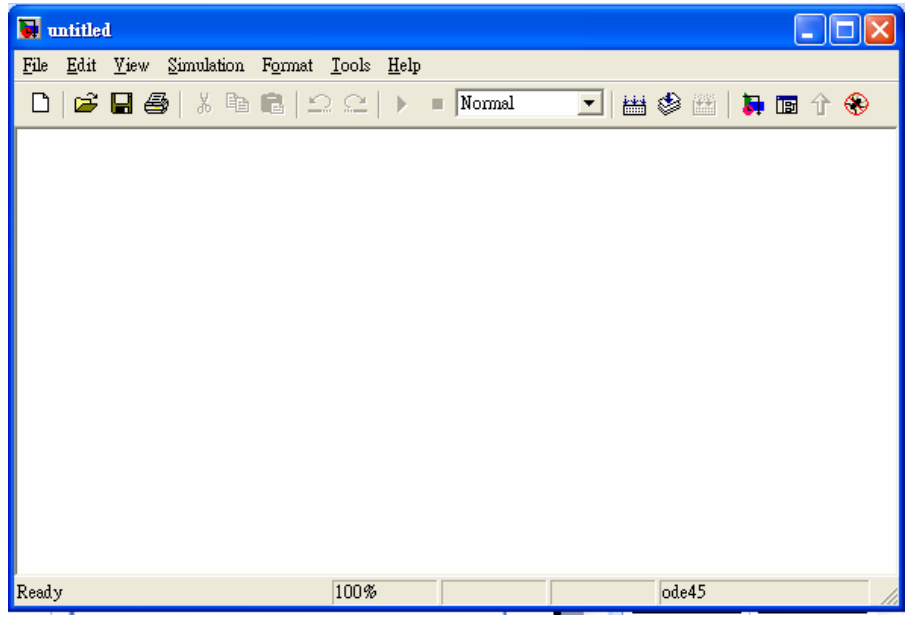

MATLAB
File Edit View Web Window Help
Current Directory: C:\MATLAB6p5\work
Workspace
Stack: Base
Name Size Bytes Class
Workspace
Current Directory
Command History
%-- 4/07/06 4:48 PM --%
Command Window
Using Toolbox Path Cache. Type "help toolbox_path_cache" for more
To get started, select "MATLAB Help" from the Help menu.
>>
Start
open a new file .M file
open Simulink Toolbox
change directory

Simulink Tutorial

- SIMULINK 設計
  - 在 matlab 環境下的模擬工具, 檔案類型爲 .mdl 檔
  - 提供圖形化的功能方塊, 建構模擬系統
  - 可加入 C , FORTRAN 語言, 並依據 S-function 的標準格式, 建立自行定義的功能方塊
  - 執行方法
    - Command window 下直接鍵入 simulink
    - New simulink model
    - File -> New -> Model

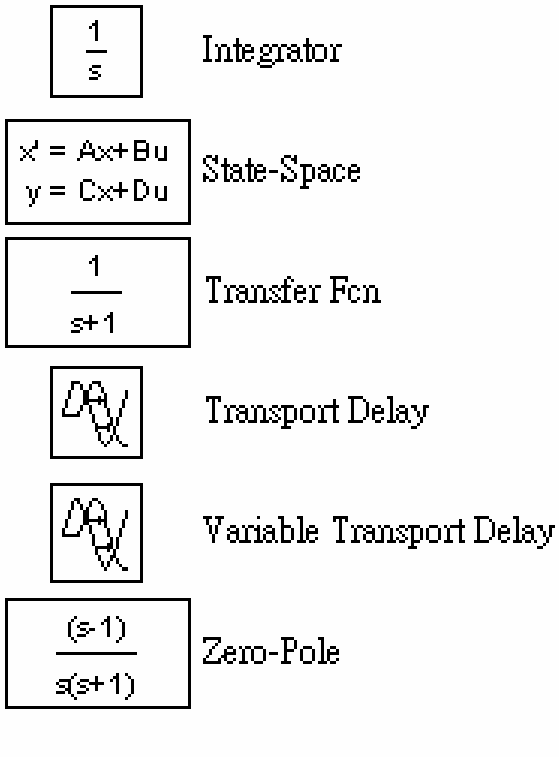
Create a new model



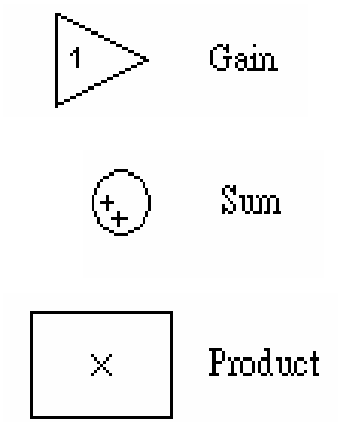


SIMULINK Library-1

continunous

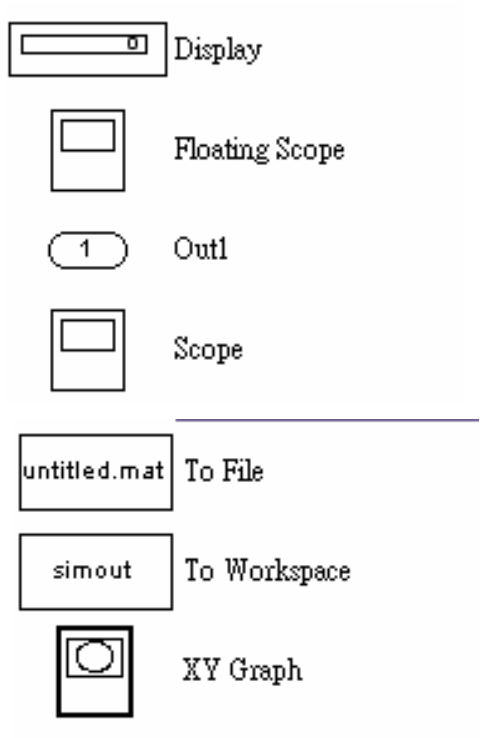


Math operations

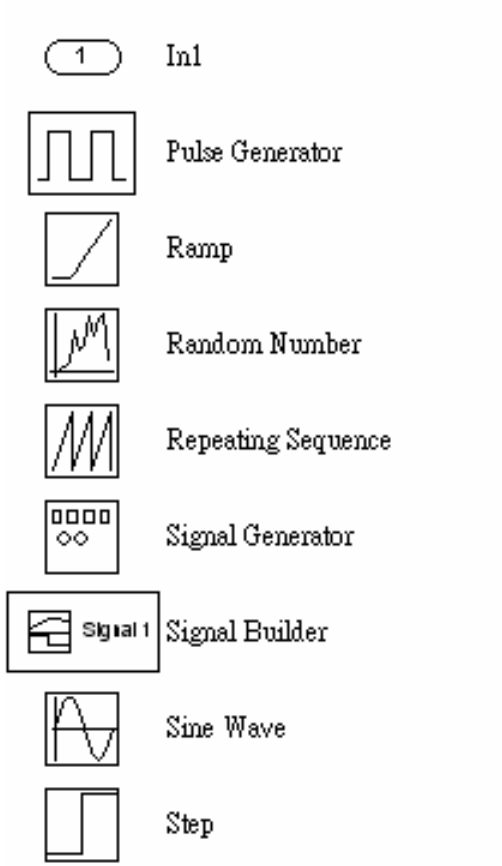


SIMULINK Library-2

sinks



source



EX.1

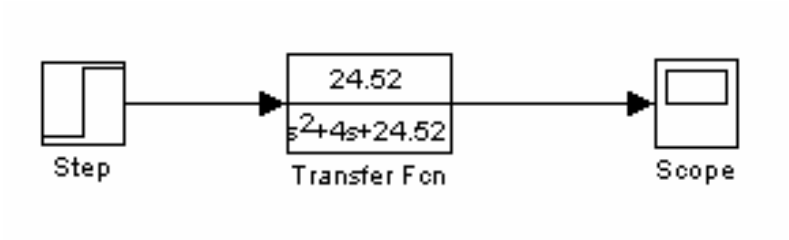
- Using SIMULINK to compare response of three-pole systems

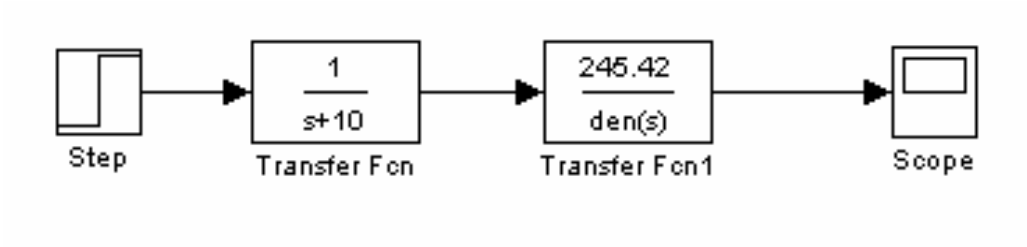
$$T_1(s) = \frac{24.542}{s^2 + 4s + 24.542}$$

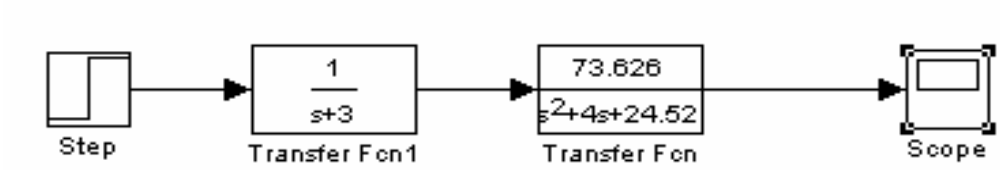
$$T_2(s) = \frac{245.42}{(s+10)(s^2 + 4s + 24.542)}$$

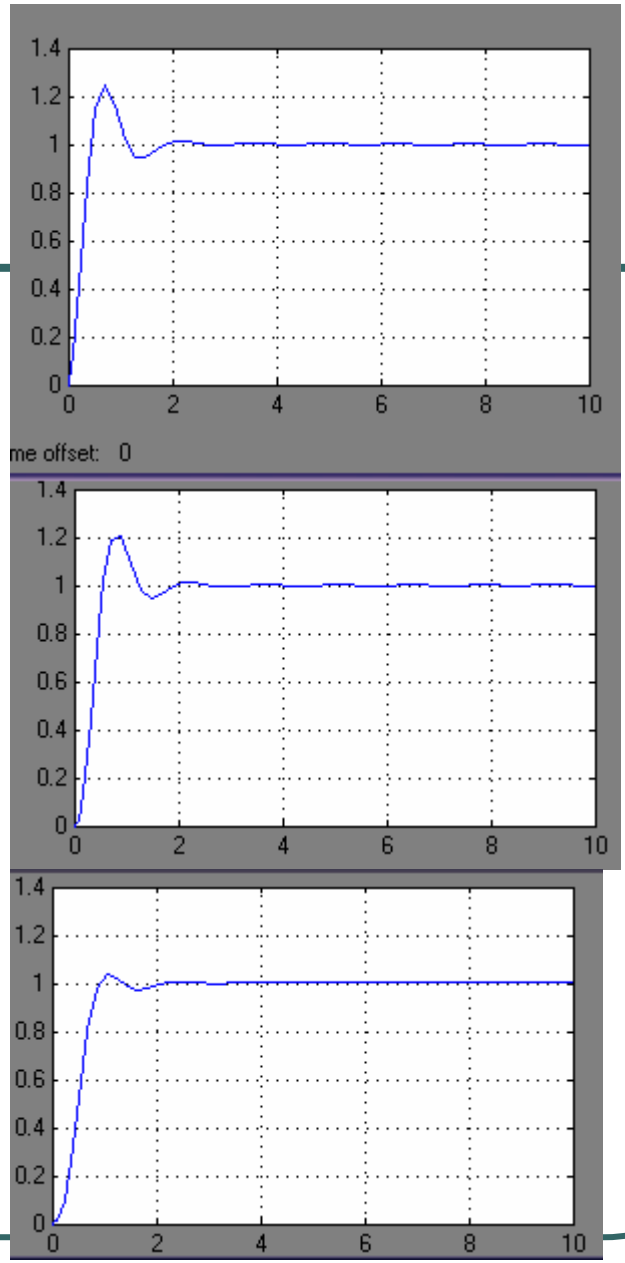
$$T_3(s) = \frac{73.626}{(s+3)(s^2 + 4s + 24.542)}$$

Sol.


24.52
s2+4s+24.52
Step
Transfer Fcn
Scope

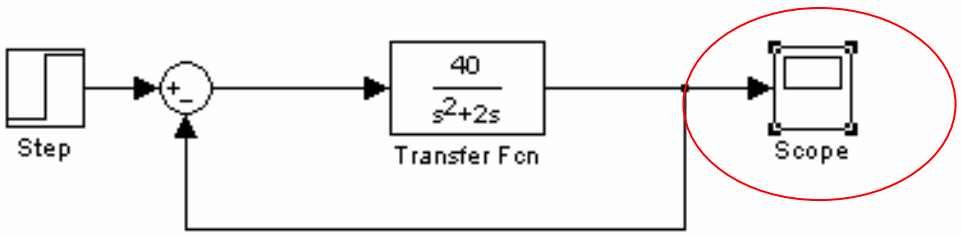

1
s+10
245.42
den(s)
Step
Transfer Fcn
Transfer Fcn1
Scope

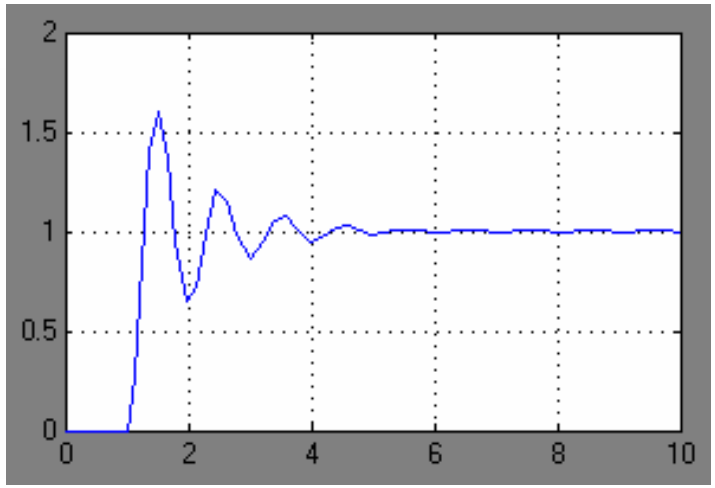

1
s+3
73.626
s2+4s+24.52
Step
Transfer Fcn1
Transfer Fcn
Scope

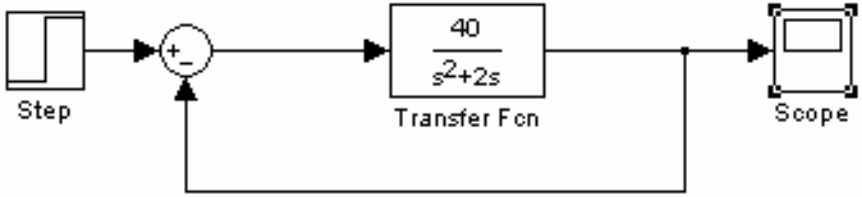

me offset: 0

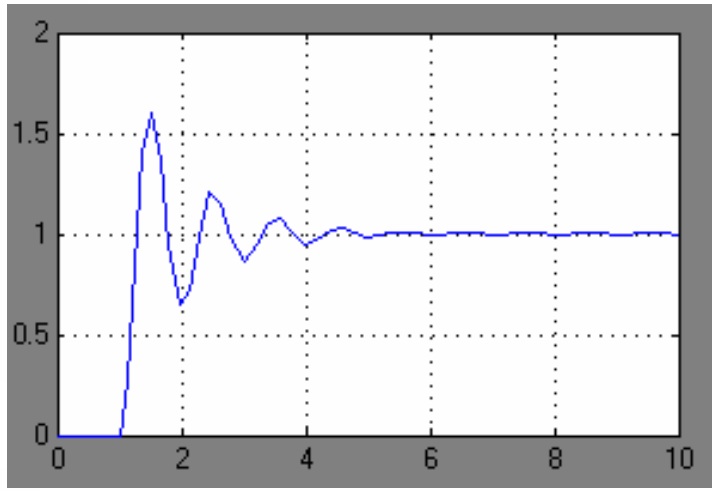
EX.2

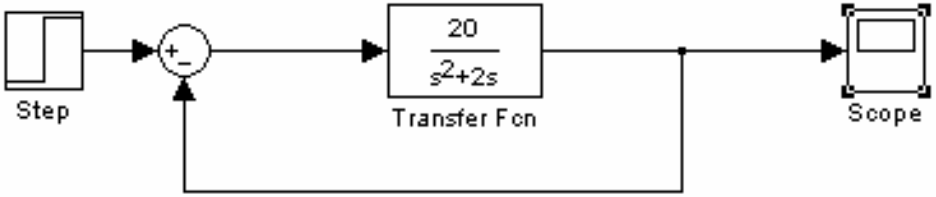
- 以Simulink模擬 $\frac{Y(s)}{X(s)} = \frac{G(s)}{1+G(s)}$ ，其中 $G(s) = \frac{40}{s^2+2s}$

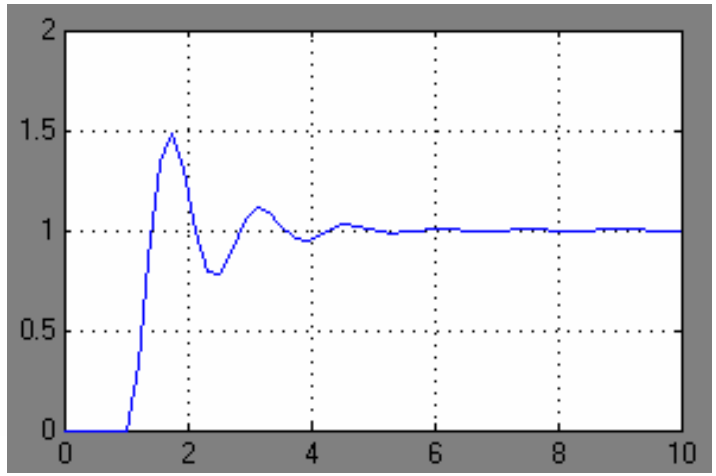


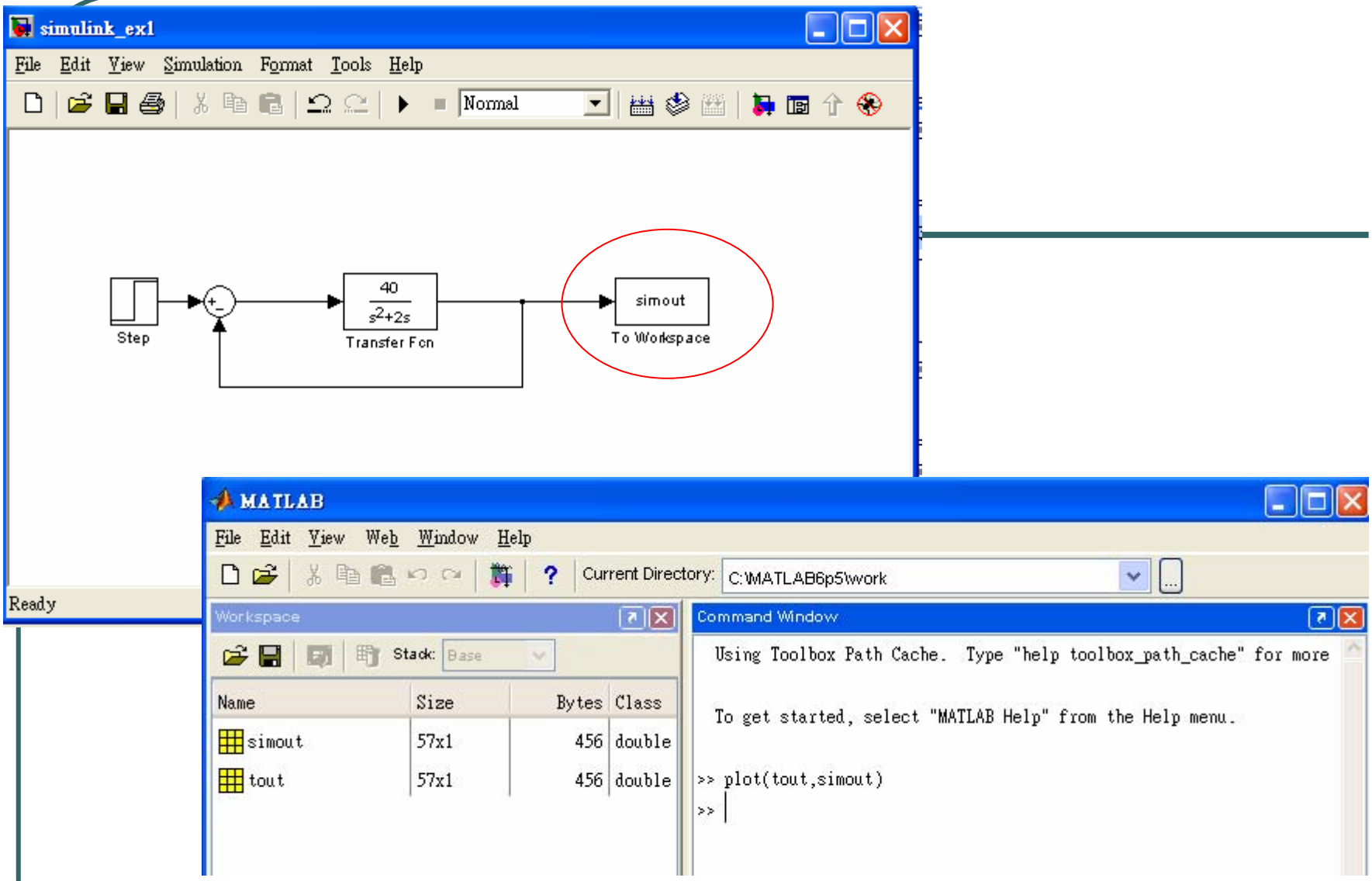



Step
+
−
40
s2+2s
Transfer Fcn
Scope


2
1.5
1
0.5
0
0
2
4
6
8
10


Step
+
−
20
s2+2s
Transfer Fcn
Scope


2
1.5
1
0.5
0
0
2
4
6
8
10


simulink_ex1
File Edit View Simulation Format Tools Help
Normal
Step
40
s2+2s
Transfer Fcn
simout
To Workspace
Ready
MATLAB
File Edit View Web Window Help
Current Directory: C:\MATLAB6p5\work
Workspace
Stack: Base
Name Size Bytes Class
simout 57x1 456 double
tout 57x1 456 double
Command Window
Using Toolbox Path Cache. Type "help toolbox_path_cache" for more
To get started, select "MATLAB Help" from the Help menu.
>> plot(tout,simout)
>>

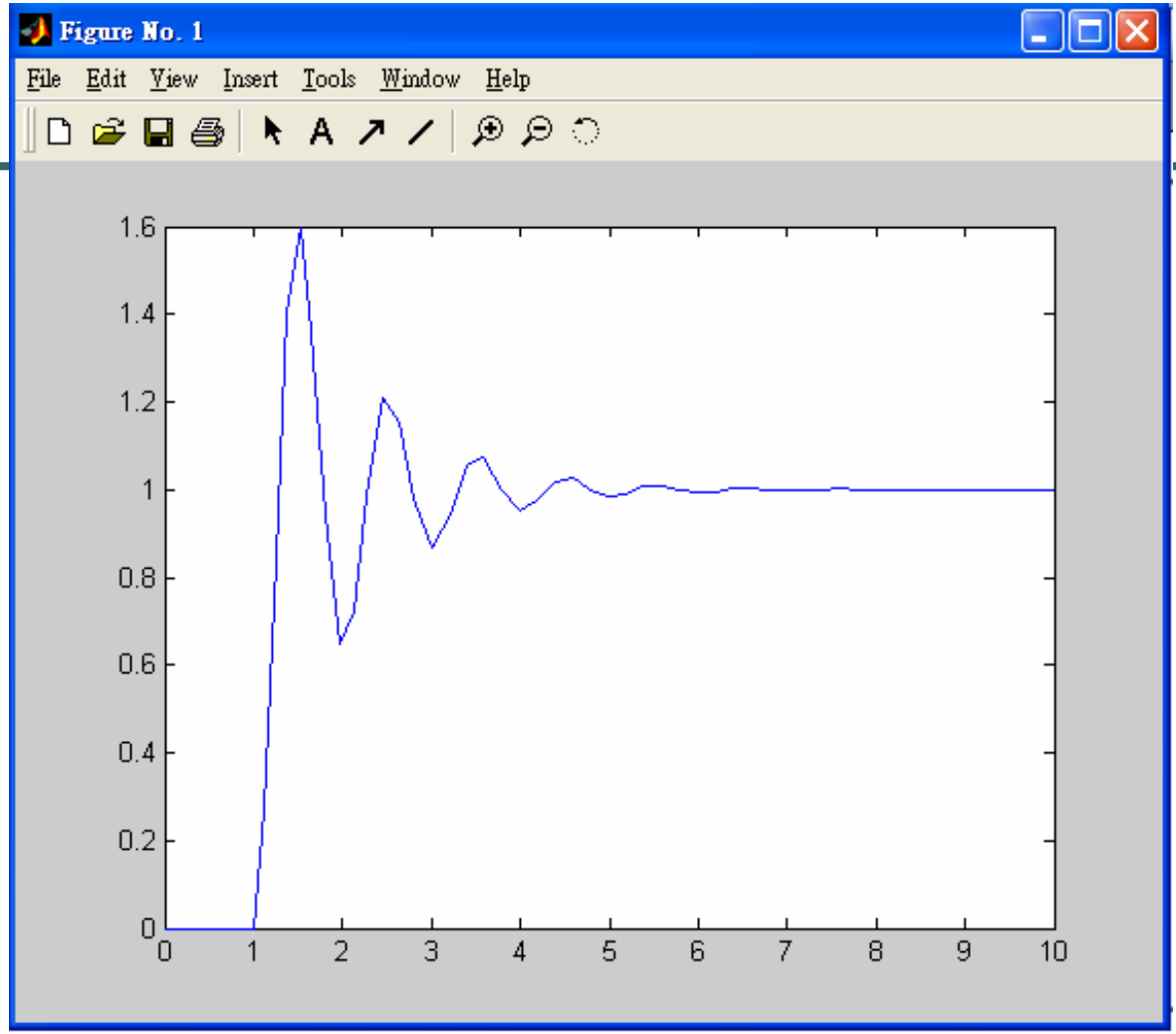


Figure No. 1
File Edit View Insert Tools Window Help
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 1 2 3 4 5 6 7 8 9 10

HOMEWORK1

- （1）$G(s)=\frac{as+4}{s^2+2s+4}$ a=0,1,2，試以simulink探討步階響應變化(畫在同一個圖上)
- （2）$G(s)=\frac{s+20}{(s+2)^2(s+5)}$ 試求脈衝及步階響應
- （3）輸入系統延遲的轉移函數爲 $G(s)=\frac{3e^{-0.25s}}{s+3}$ 試以simulink畫出步階響應圖