System Dynamics and Control

~ Automatic Control Web Course ~

Simulink　Version 3.0

光機電實驗室
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V1.0

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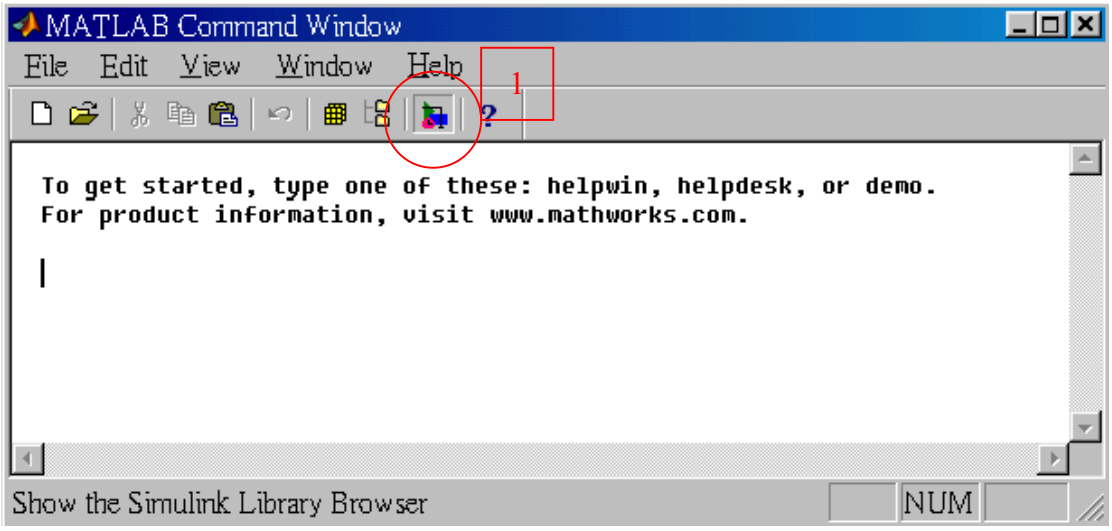
一、簡介：

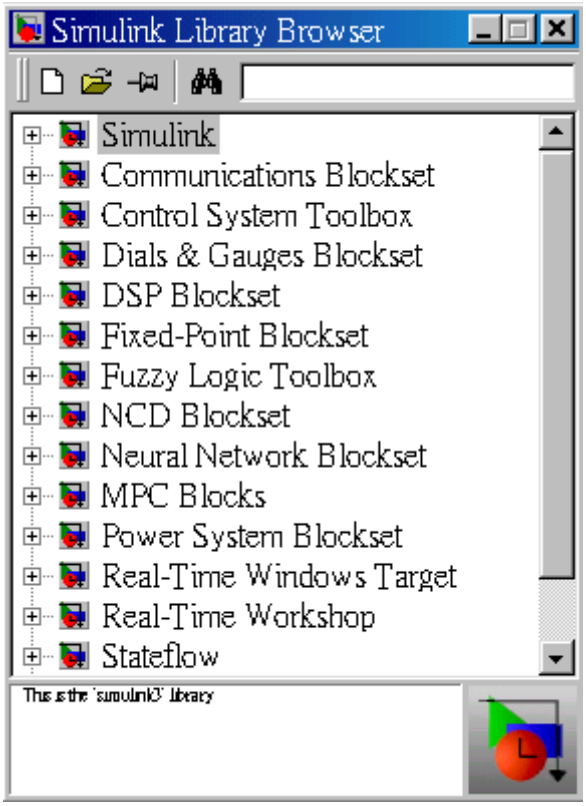
Simulink (Dynamic System Simulation)，為 MATLAB 的應用工具盒(Toolbox)之一，主要功能是對動態系統進行模擬與分析，藉以獲得較佳系統效能。
隨後將從 Simulink 操作介面介紹、模型建立、模擬與結果分析等三部分內容進行 Simulink Toolbox 簡介及應用：

二、Simulink 操作介面介紹

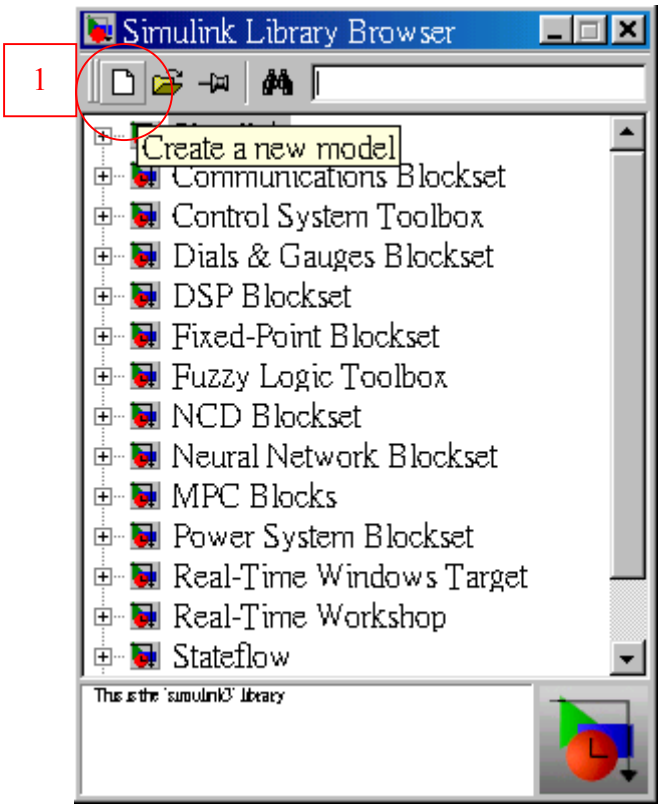
＊如何進入 Simulink 介面？



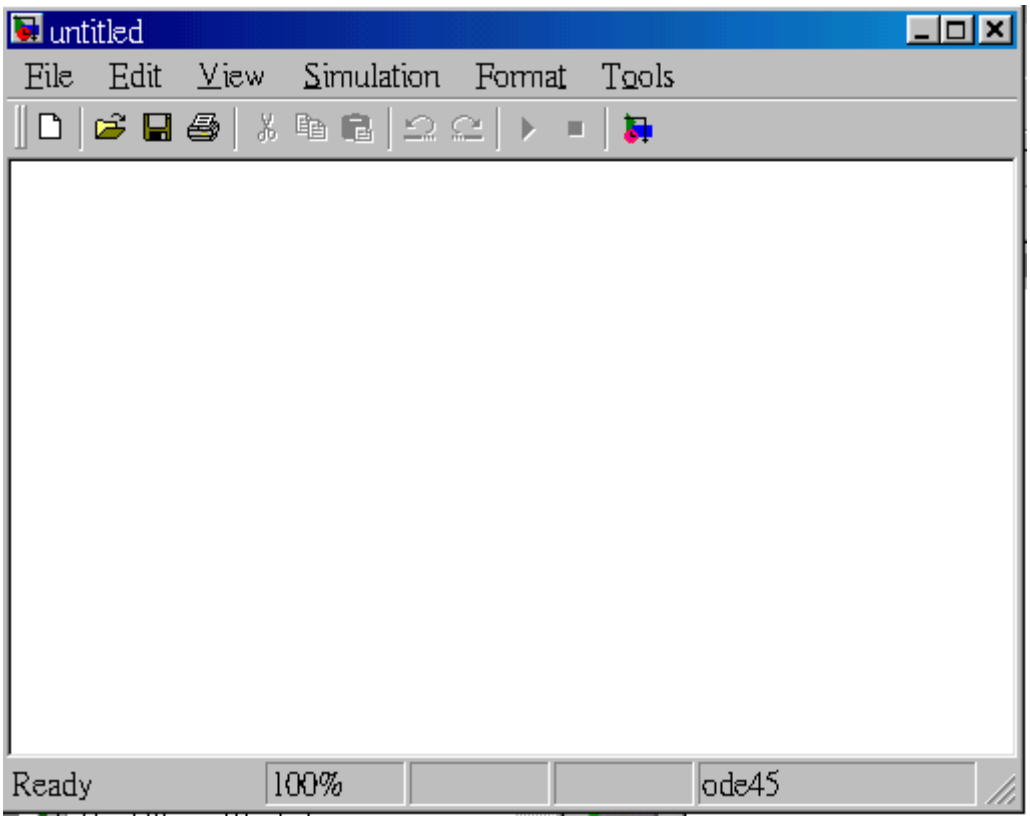
點選 1 即進入下圖畫面



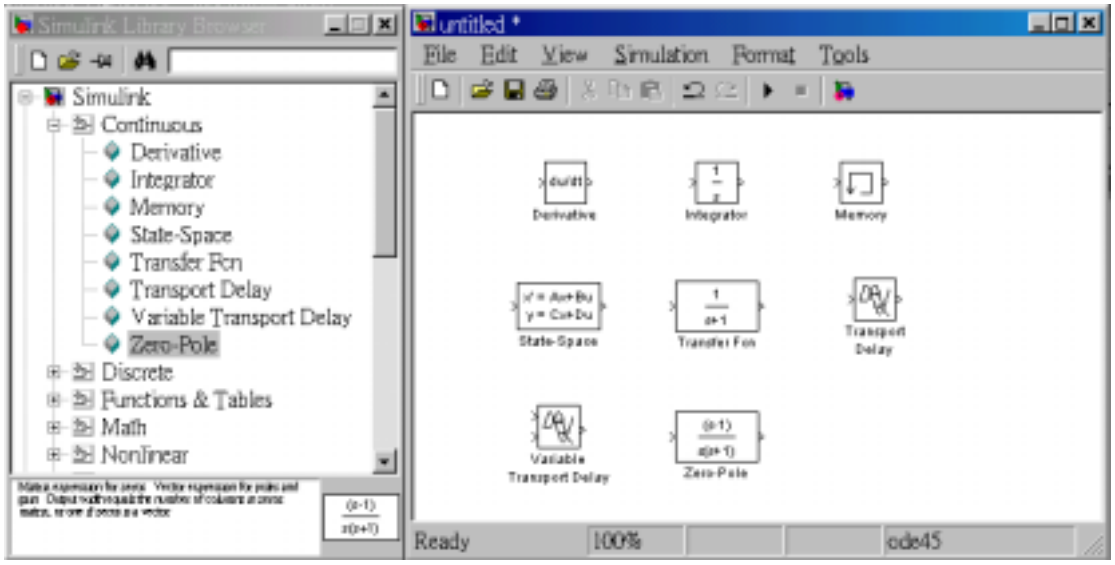
＊如何開啟 Simulink new model？

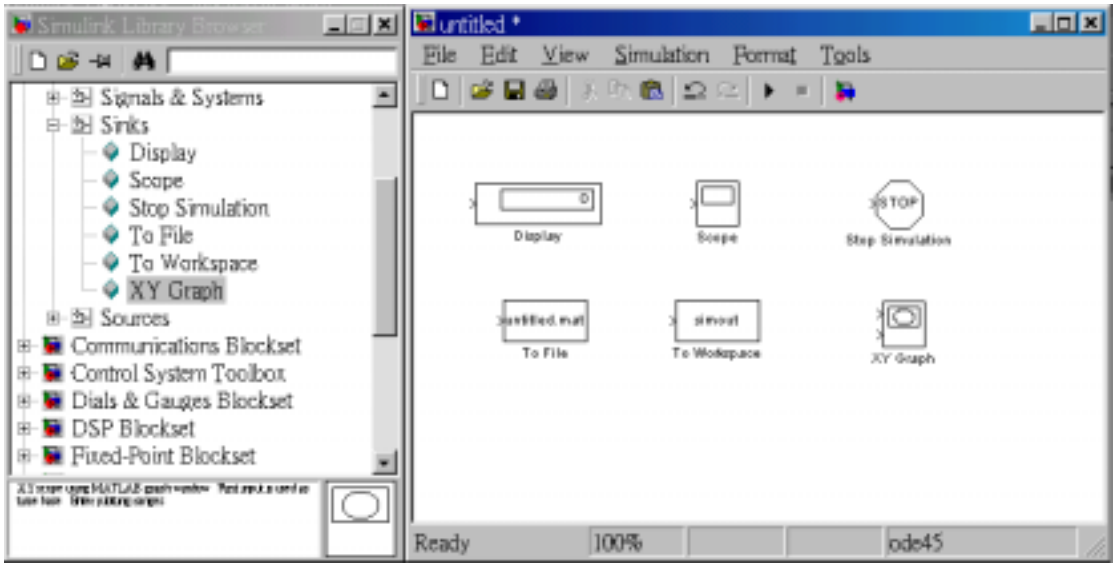


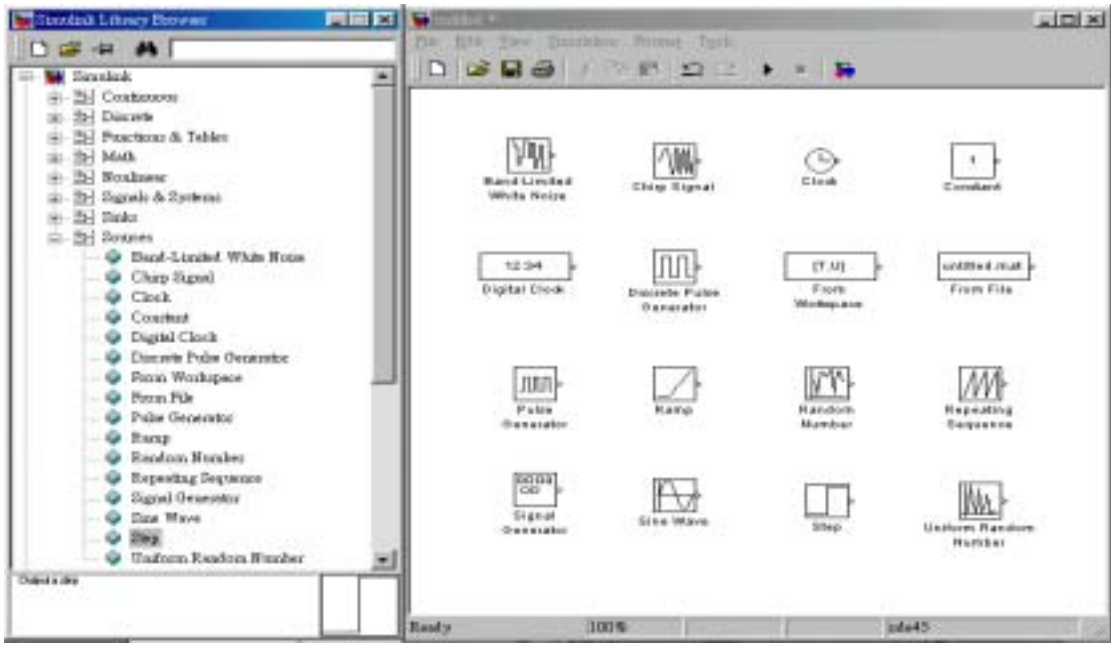
點選 1 即進入下圖畫面



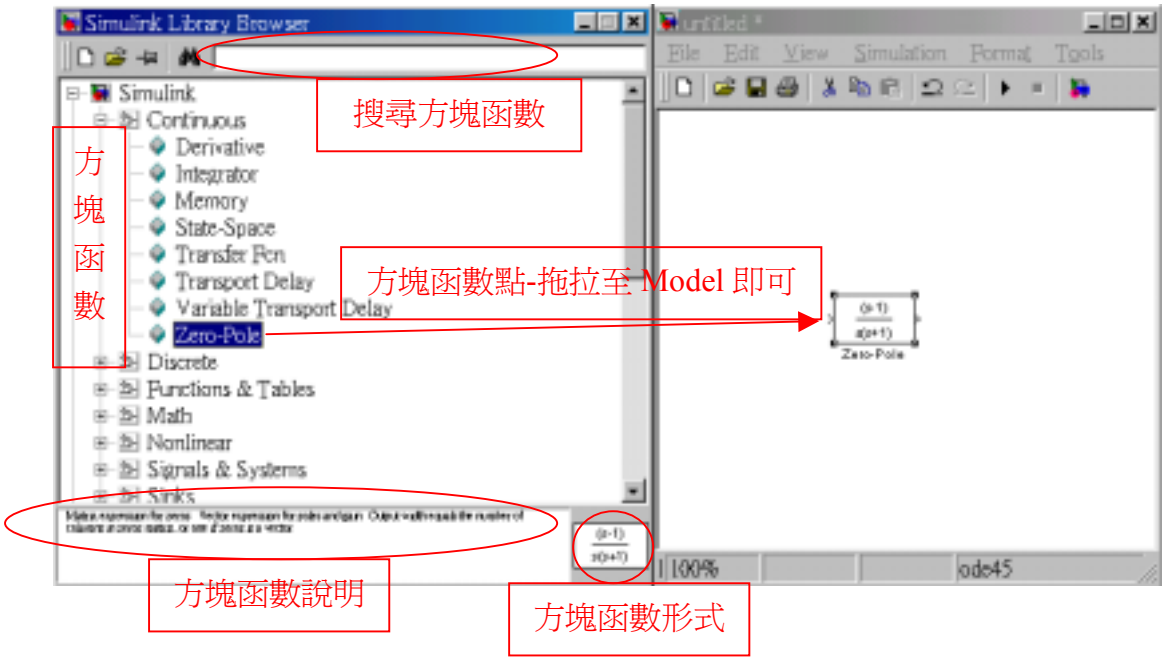
※較常用方塊函數？


Simulink Library Browser
Simulink
Continuous
Derivative
Integrator
Memory
State-Space
Transfer Fcn
Transport Delay
Variable Transport Delay
Zero-Pole
Discrete
Functions & Tables
Math
Nonlinear
untitled *
File Edit View Simulation Format Tools
Derivative
Integrator
Memory
State-Space
Transfer Fcn
Transport Delay
Variable Transport Delay
Zero-Pole
Ready
100%
ode45


Simulink Library Browser
Signals & Systems
Sinks
Display
Scope
Stop Simulation
To File
To Workspace
XY Graph
Sources
Communications Blockset
Control System Toolbox
Dials & Gauges Blockset
DSP Blockset
Fixed-Point Blockset
untitled *
File Edit View Simulation Format Tools
Display
Scope
Stop Simulation
To File
To Workspace
XY Graph
Ready
100%
ode45

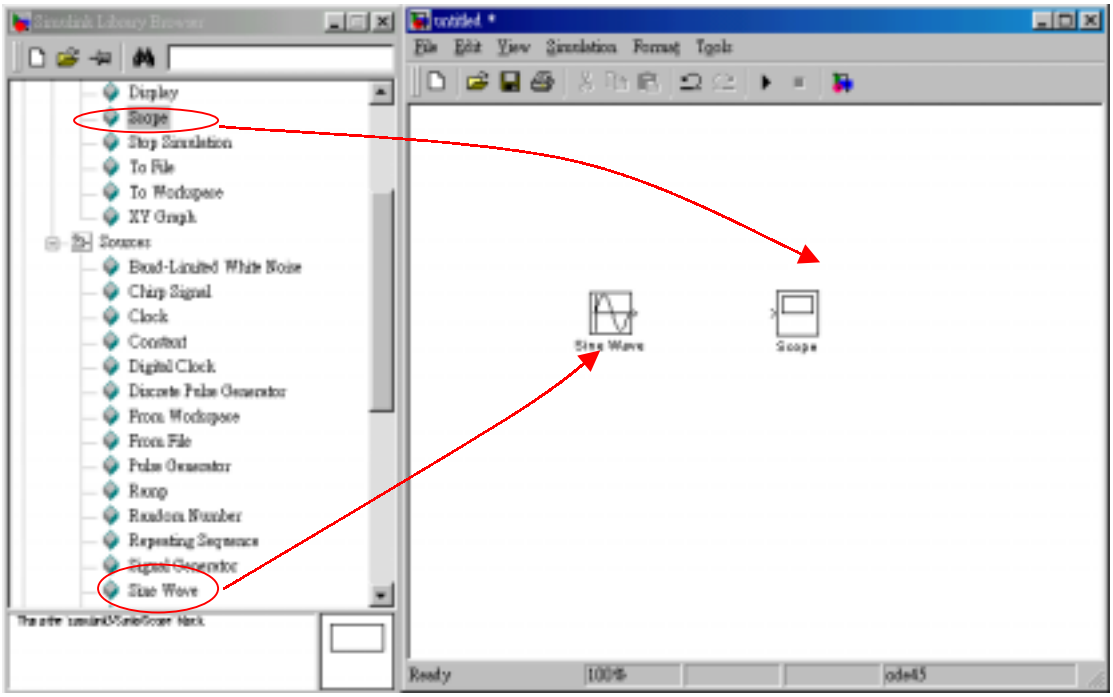

Simulink Library Browser
Band-Limited White Noise
Chirp Signal
Clock
Constant
Digital Clock
Discrete Pulse Generator
From Workspace
From File
Pulse Generator
Ramp
Random Number
Repeating Sequence
Signal Generator
Sine Wave
Step
Uniform Random Number

三、Simulink Library Browser 介紹

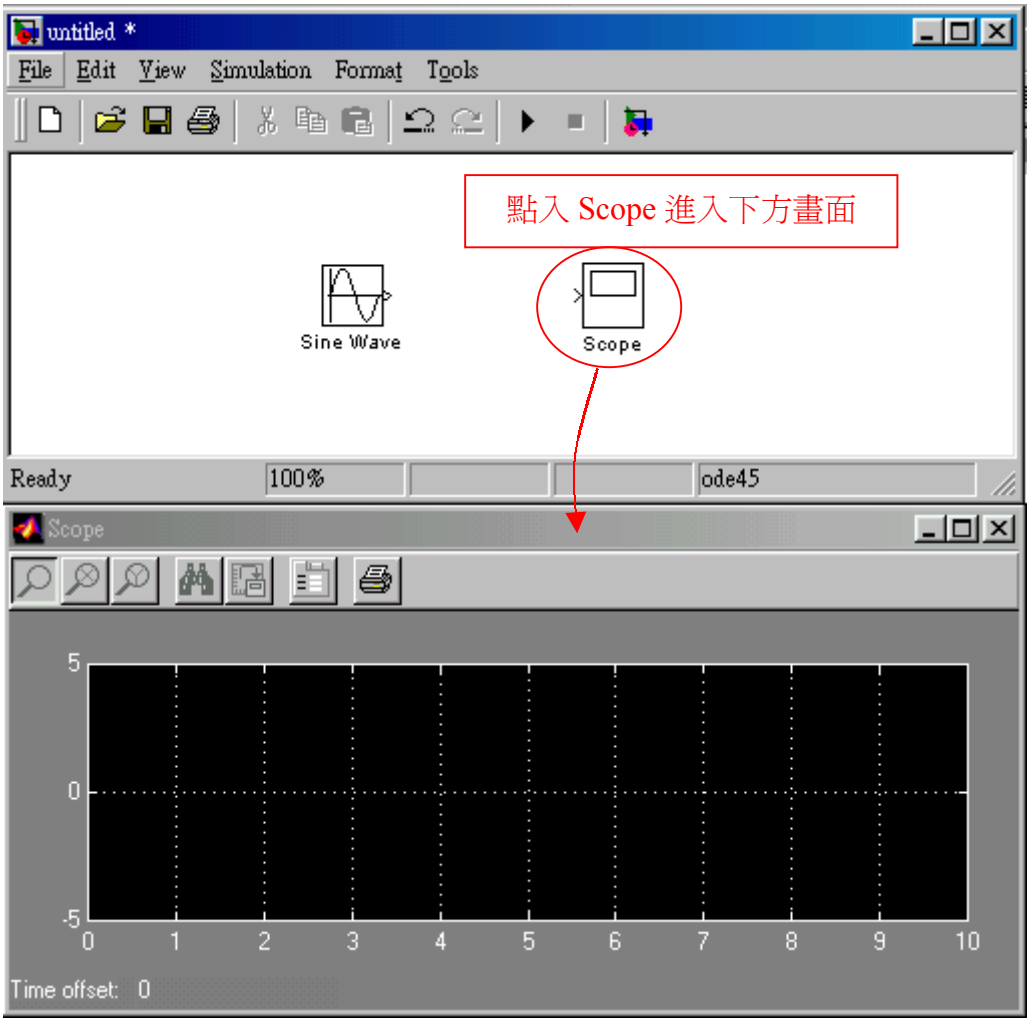


＊如何送出訊號/顯示訊號？

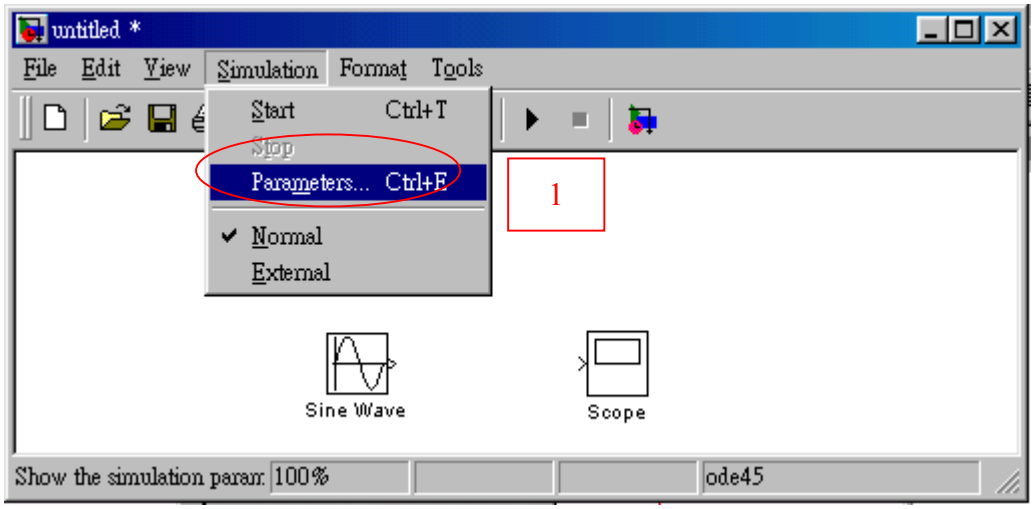
Step 1 點拖拉"Scope" & "Chirp Signal"至 Model

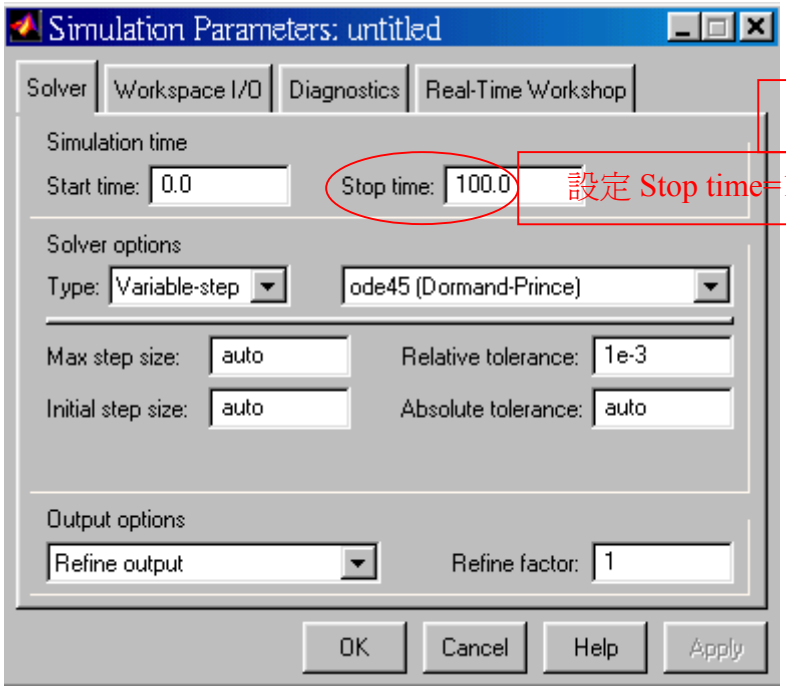


Step 2 將兩個方塊連結,再點入 Scope 方塊進入下方畫面



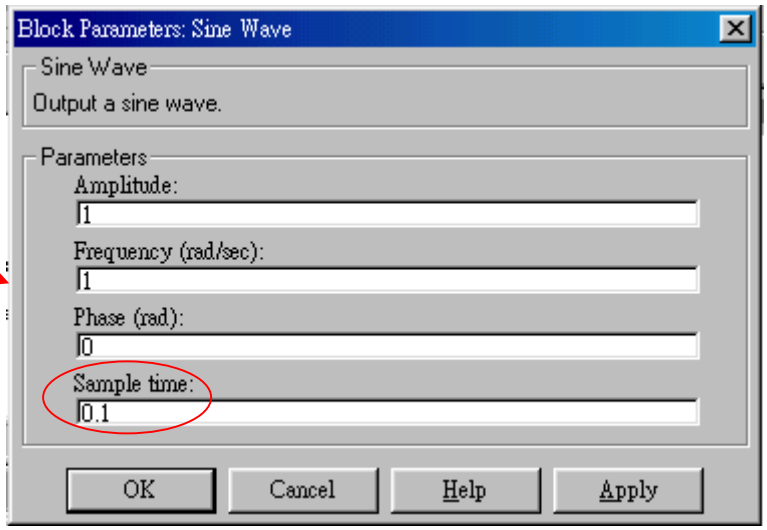
Step 3 設定參數





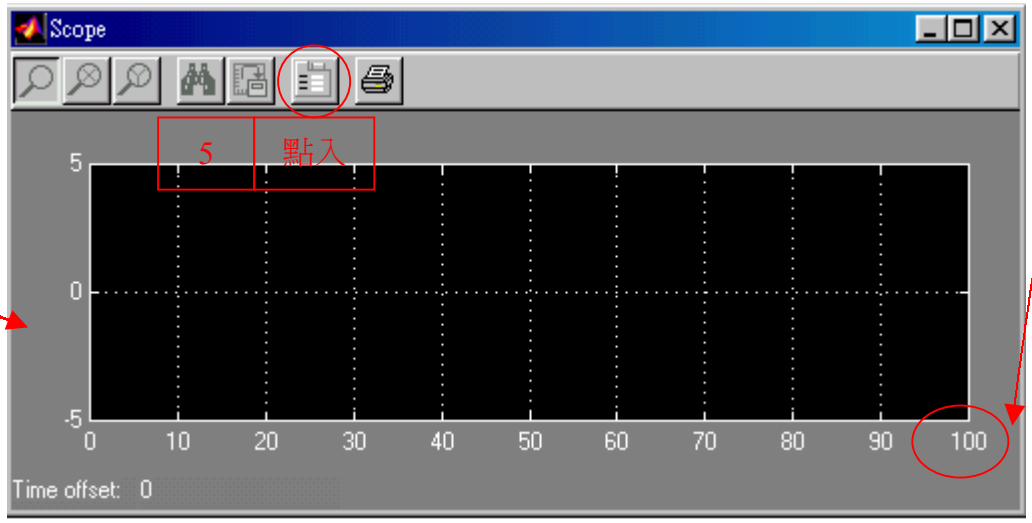
2

設定 Stop time=100



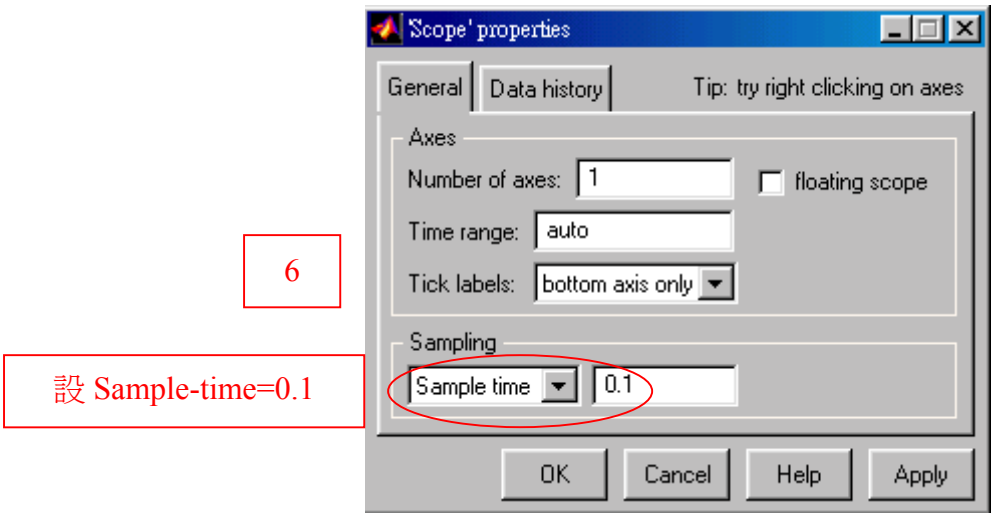
3

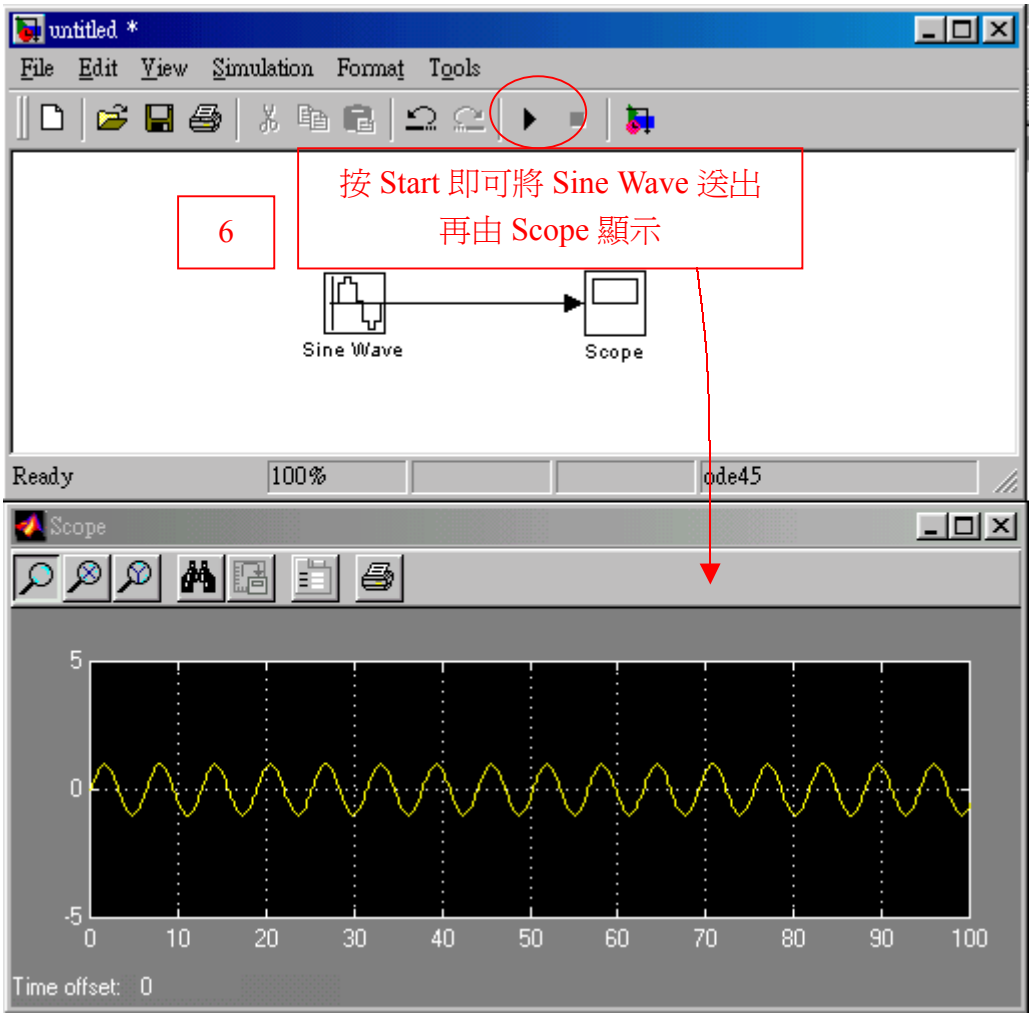
點入方塊函數



4

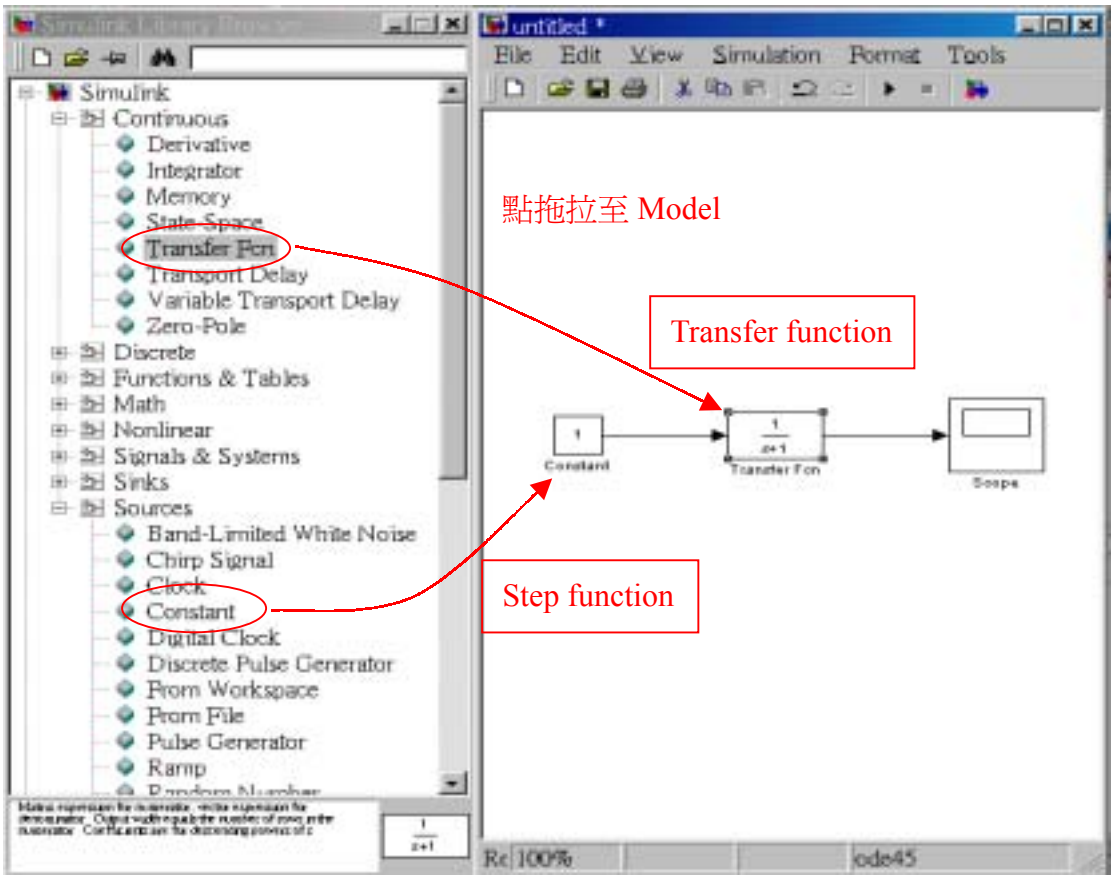
點入方塊函數


6
設 Sample-time=0.1
Scope' properties
General
Data history
Tip: try right clicking on axes
Axes
Number of axes: 1
floating scope
Time range: auto
Tick labels: bottom axis only
Sampling
Sample time
0.1
OK
Cancel
Help
Apply

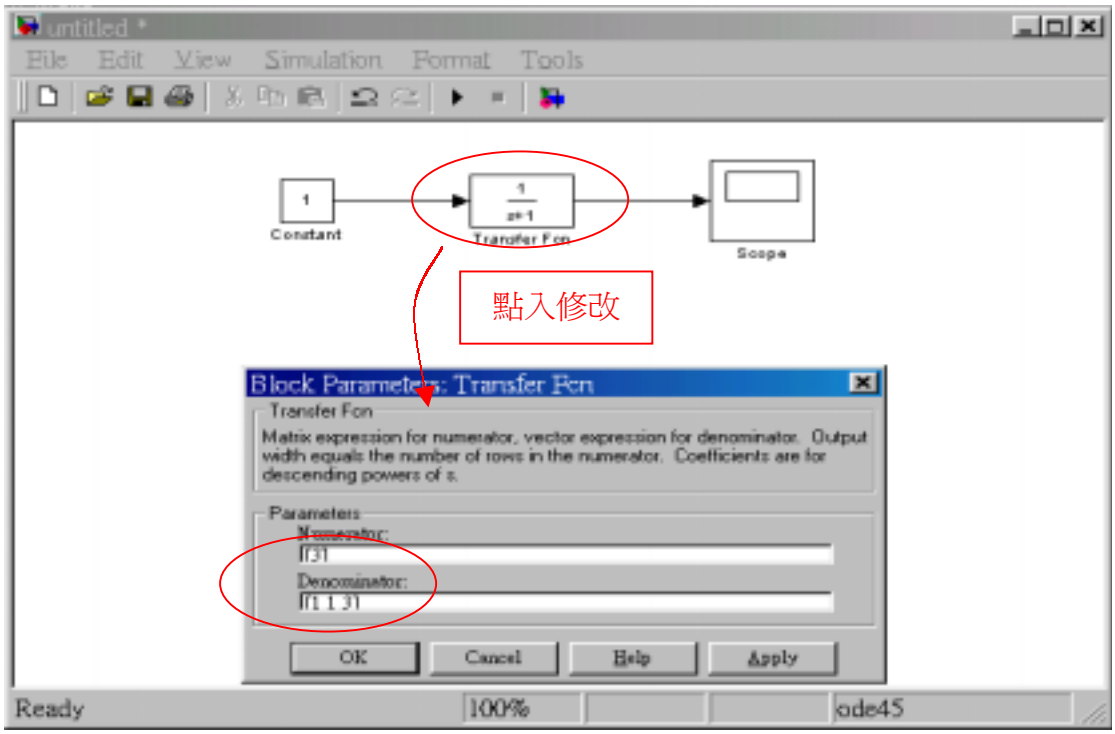

untitled *
File Edit View Simulation Format Tools
6
按 Start 即可將 Sine Wave 送出
再由 Scope 顯示
Sine Wave
Scope
Ready
100%
ode45
Scope
5
0
-5
0 10 20 30 40 50 60 70 80 90 100
Time offset: 0

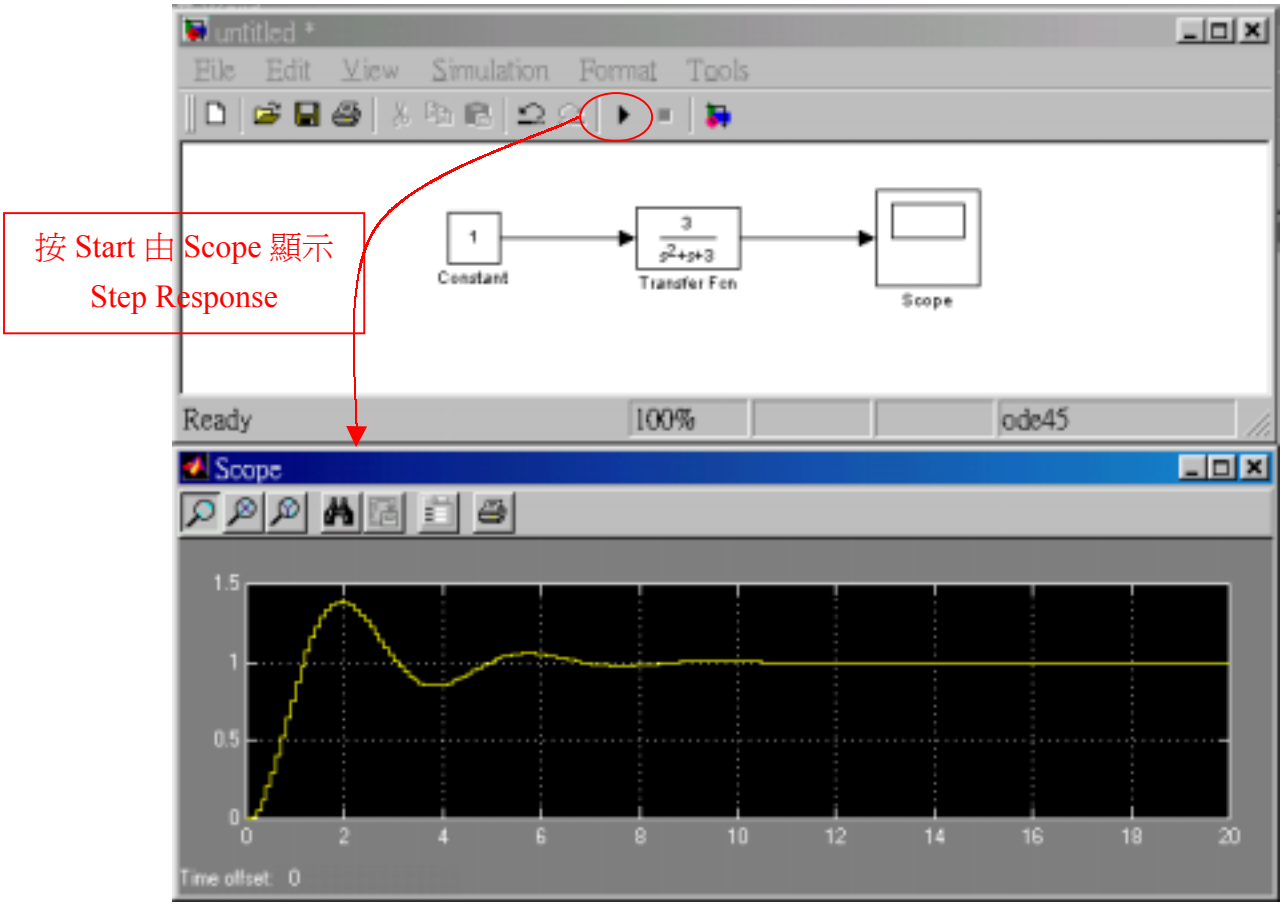
四、控制應用

＊如何獲得二階線性非時變系統步階響應？



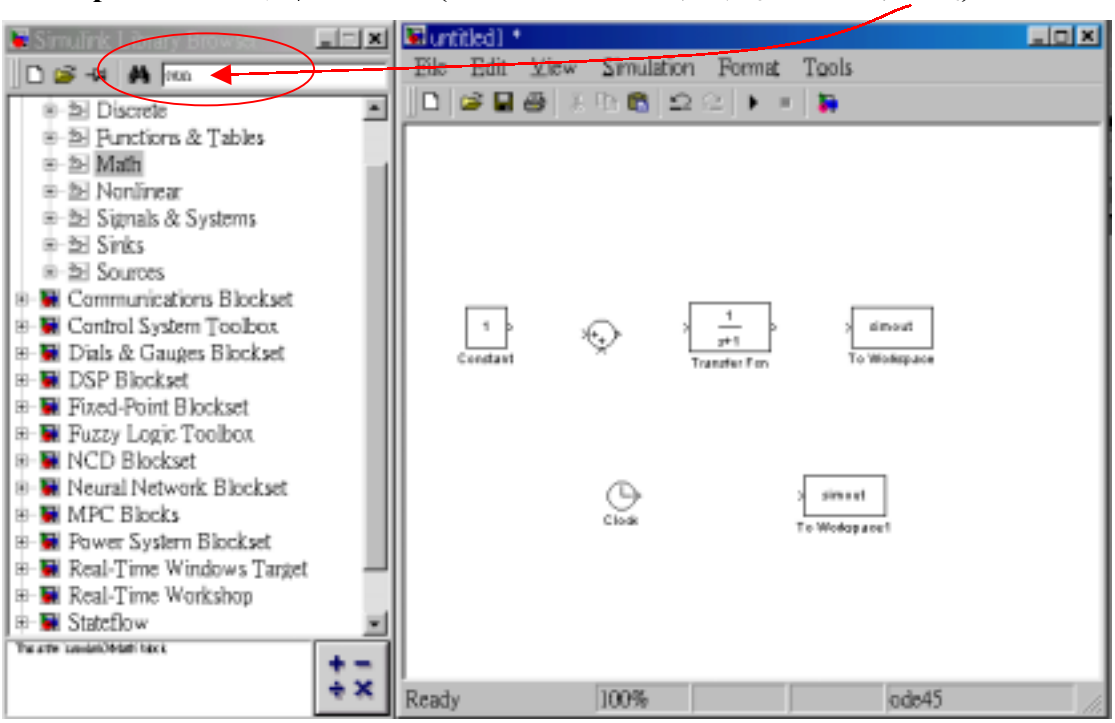
參數修改



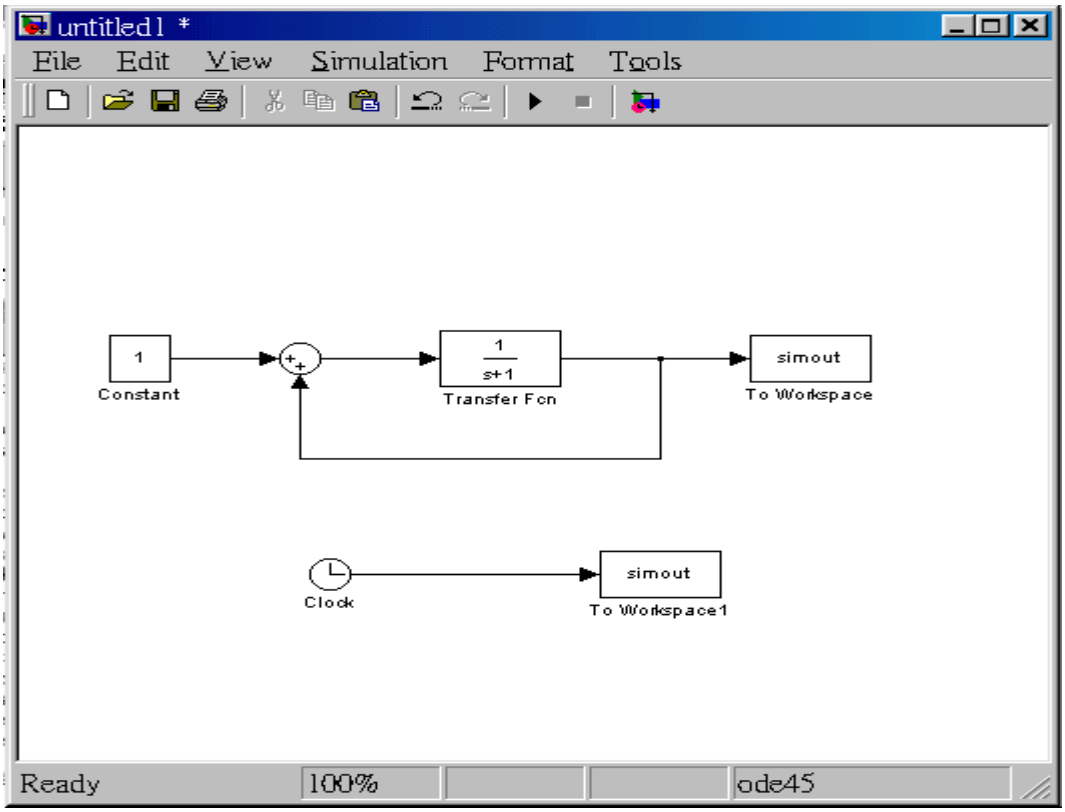


＊如何將閉迴路系統步階響應資料存入變數？

Step I 拖拉出所需方塊函數(若不知方塊函數在何處可採搜尋方式)

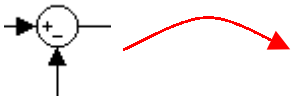


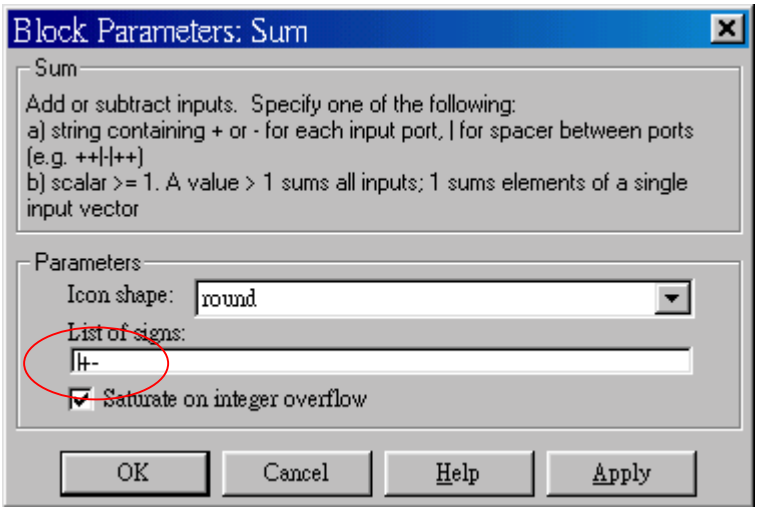
Step II 連結方塊函數並點入方塊函數以調整參數



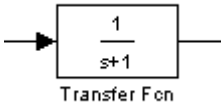
Step III 調整參數

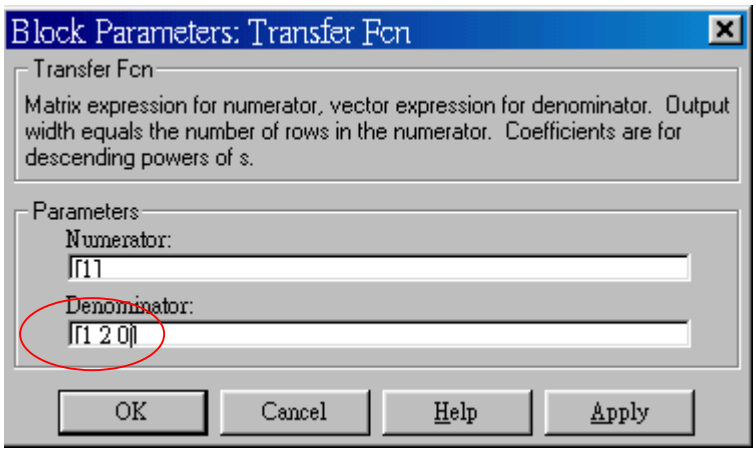
點入方塊函數



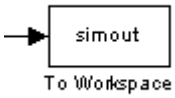


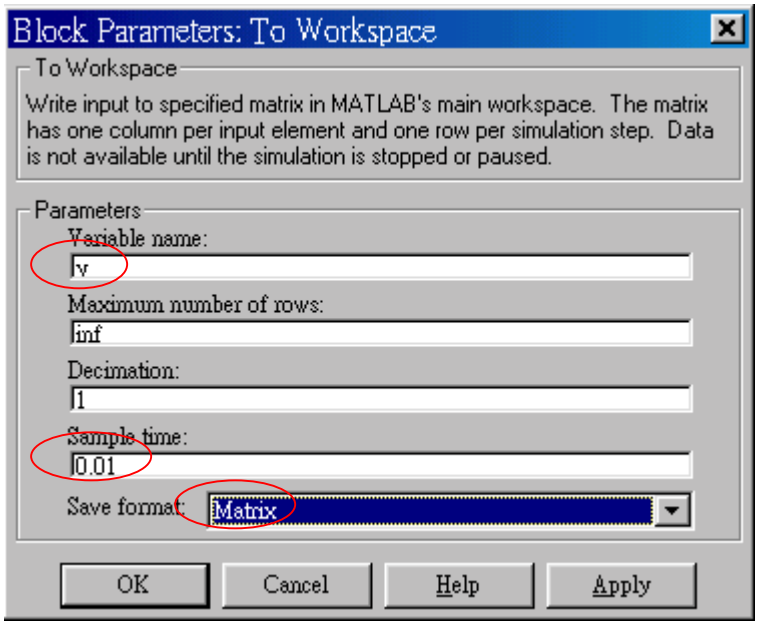
點入方塊函數



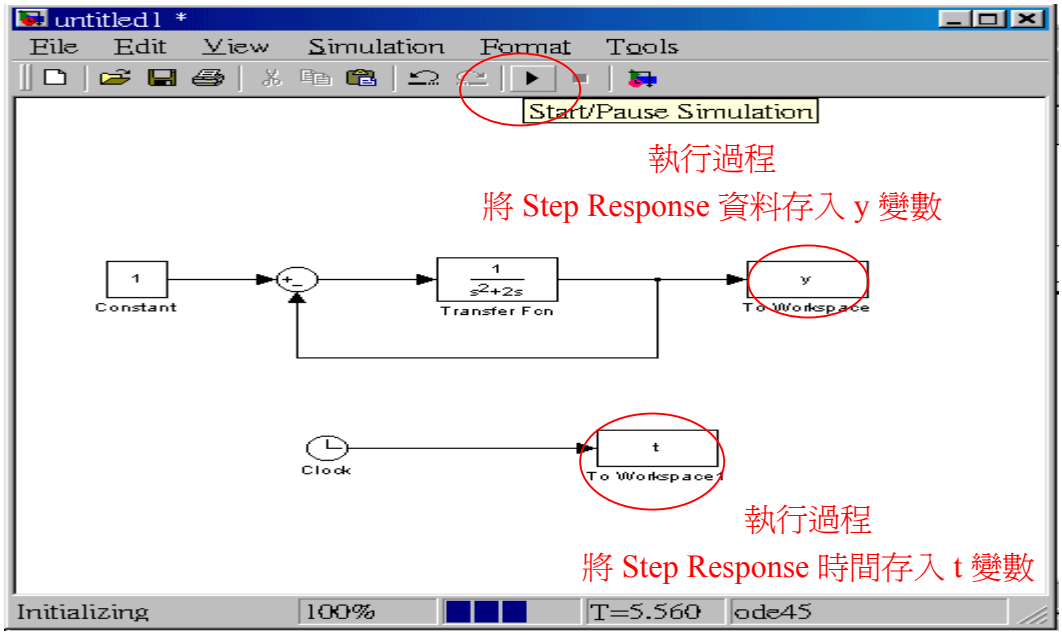


點入方塊函數

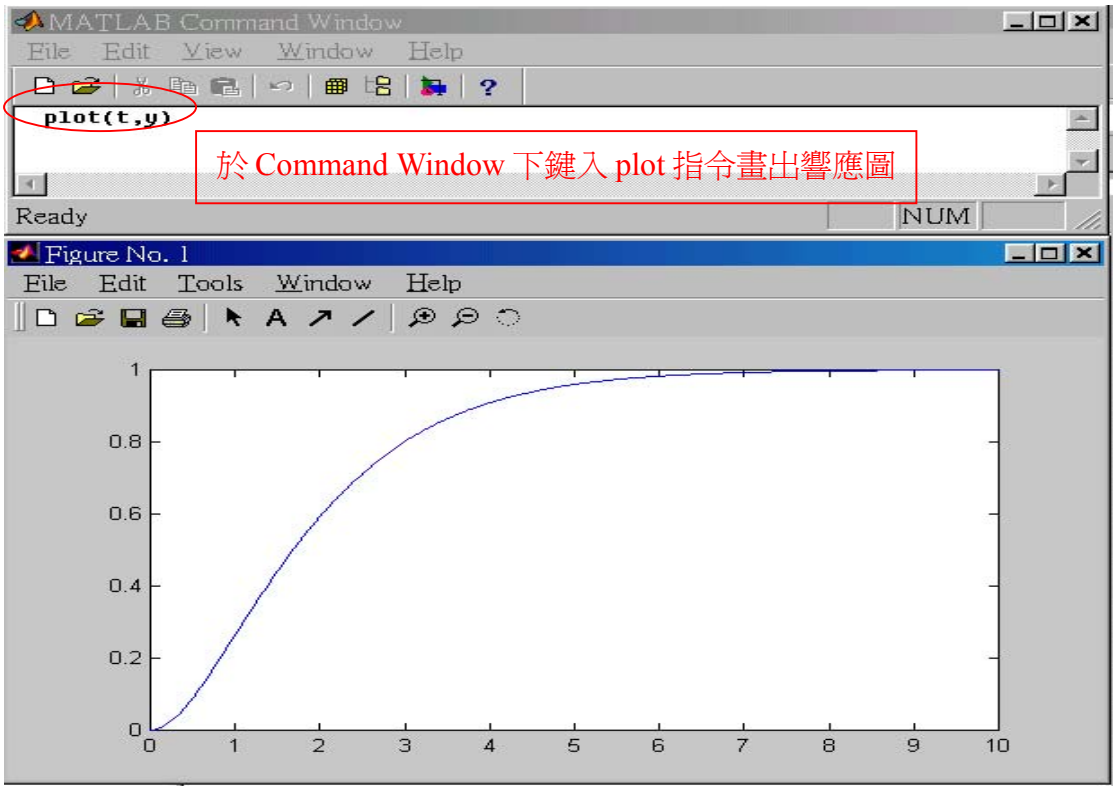




Step IV 執行系統響應模擬

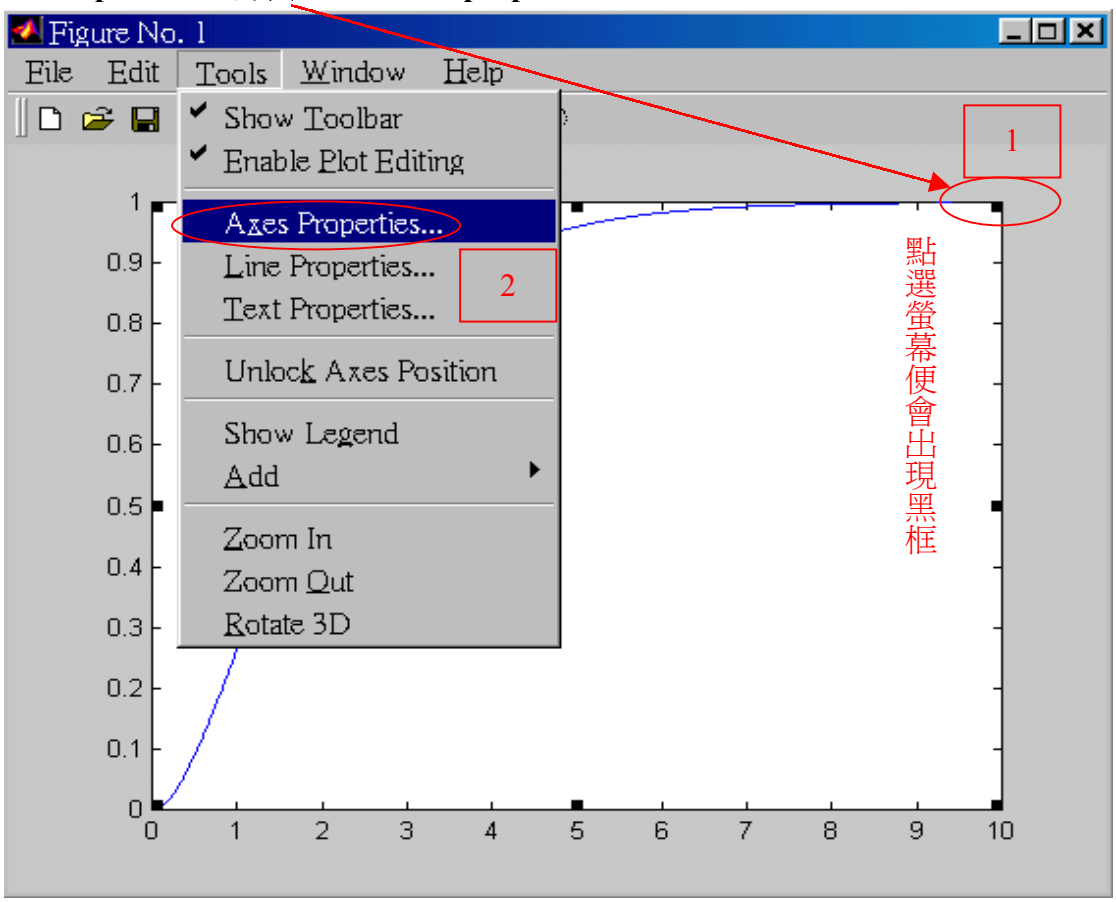


Step V 在 Command Window 下畫出響應圖整參數

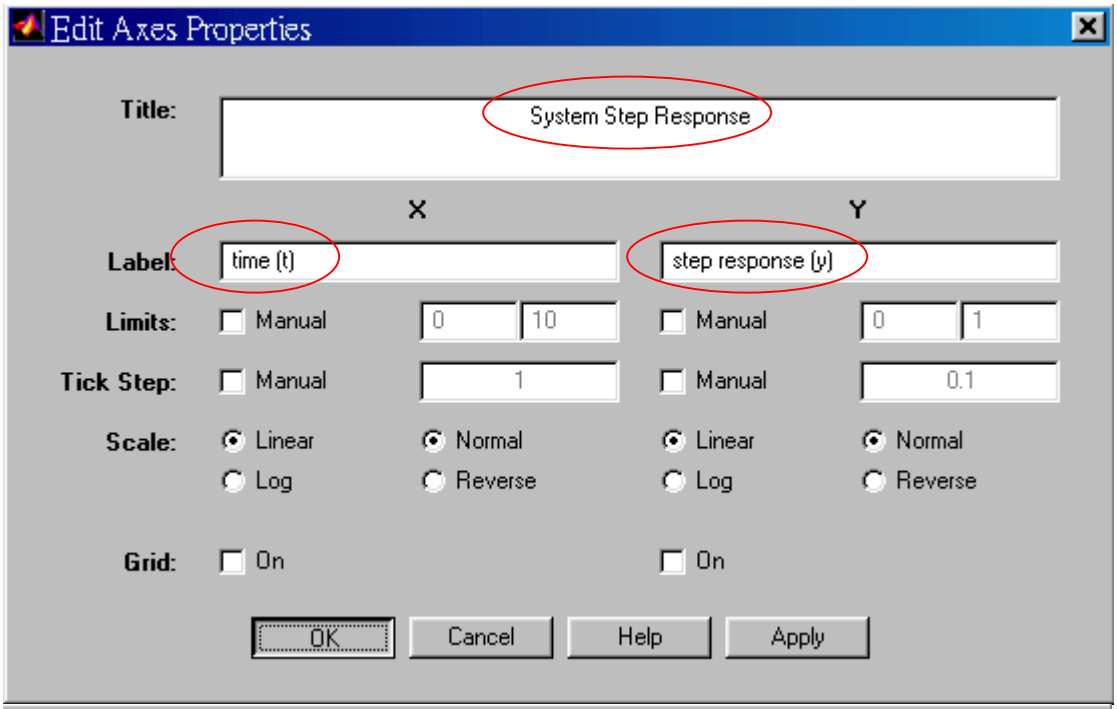


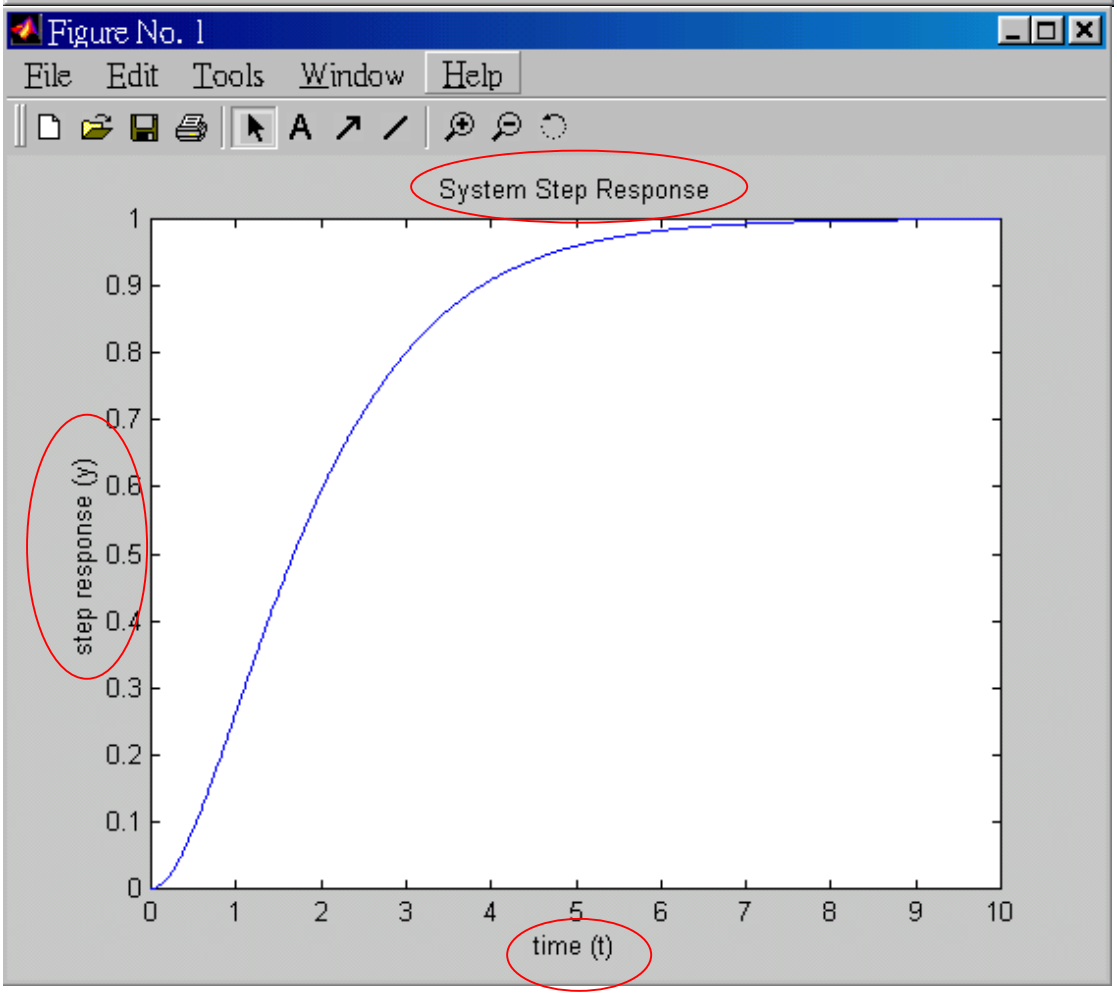
＊於 Figure 顯示座標標記

Step I 先點選螢幕 → Axes properties



Step II 鍵入 Title、Xlabel、label





附錄：LTI Viewer

一、The LTI Viewer：Description

LTI Viewer 是 Matlab 十分方便的工具，便於獲得線性非時變系統之時域及頻域響應，如步階響應、脈衝響應、波德圖、奈氏圖、極零點圖。對於圖上臨界點亦可使用滑鼠直接點選獲得。

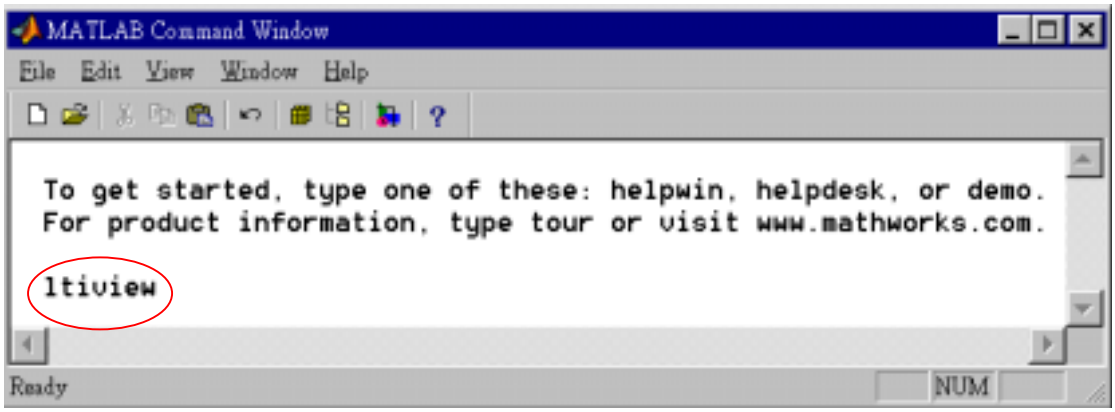
Critical points available for each plot in Matlab's LTI Viewer

	Peak time	Settling time	Rise time	Steady state value	Gain/phase margins	Pole-zero value
Step	*	*	*	*		
Impulse	*	*				
Bode	*				*	
Nyquist					*	
Nichols					*	
Pole-zero						*

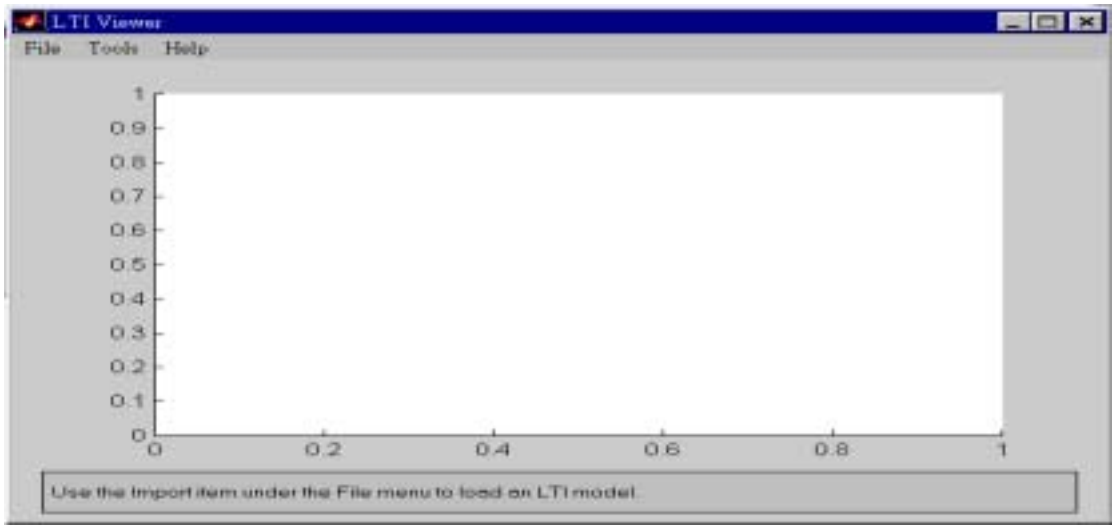
二、Using the LTI Viewer

＊Access the LTI Viewer

在 Matlab Command Window 鍵入"ltiview"指令

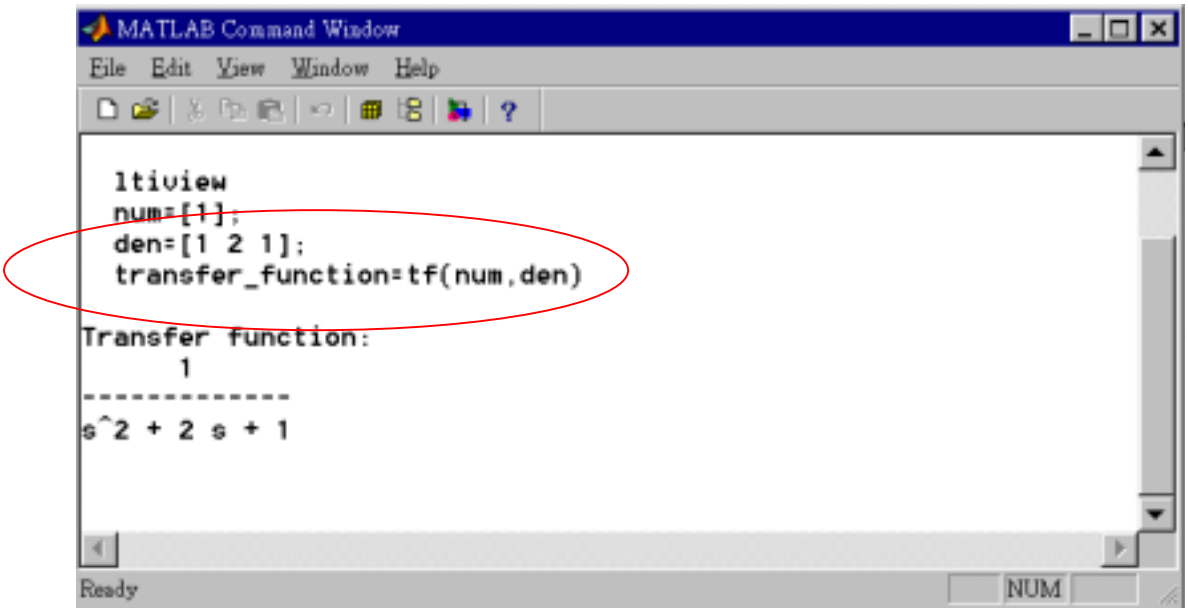


進入下圖畫面

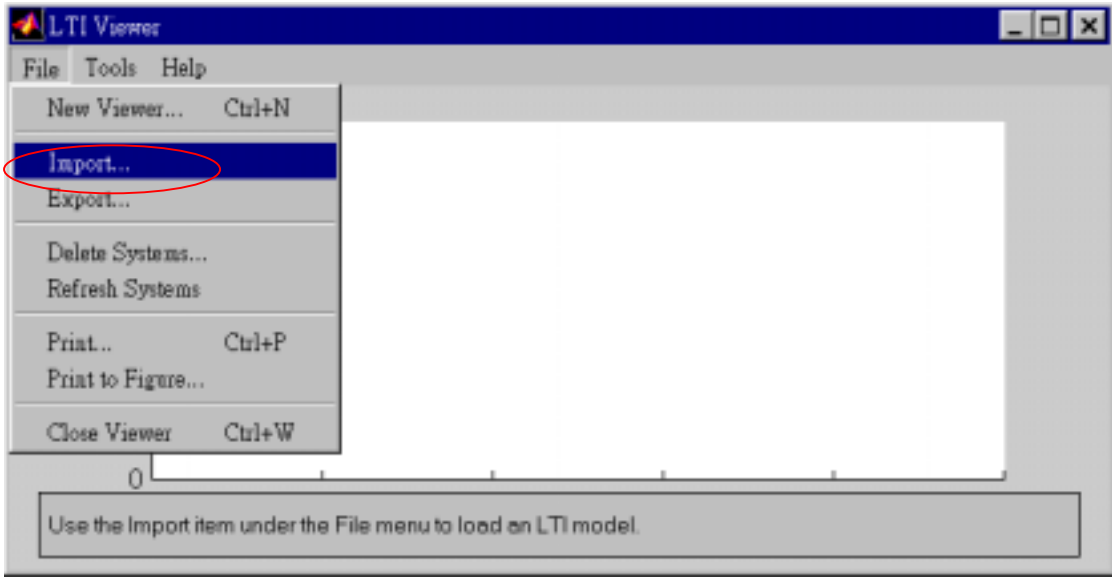


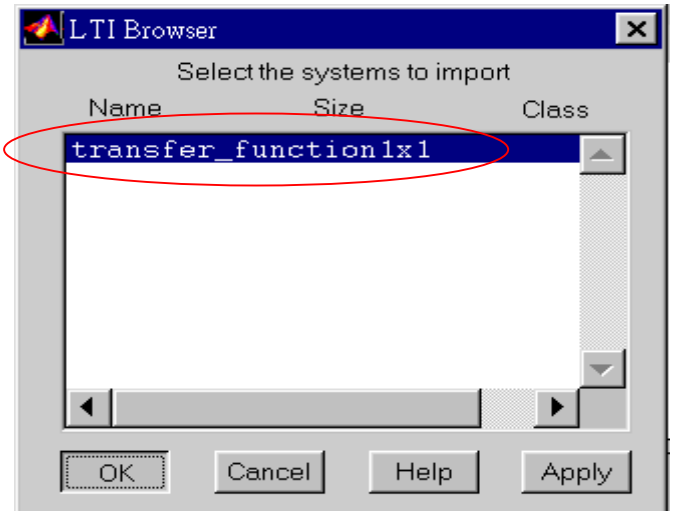
＊Create LTI transfer functions

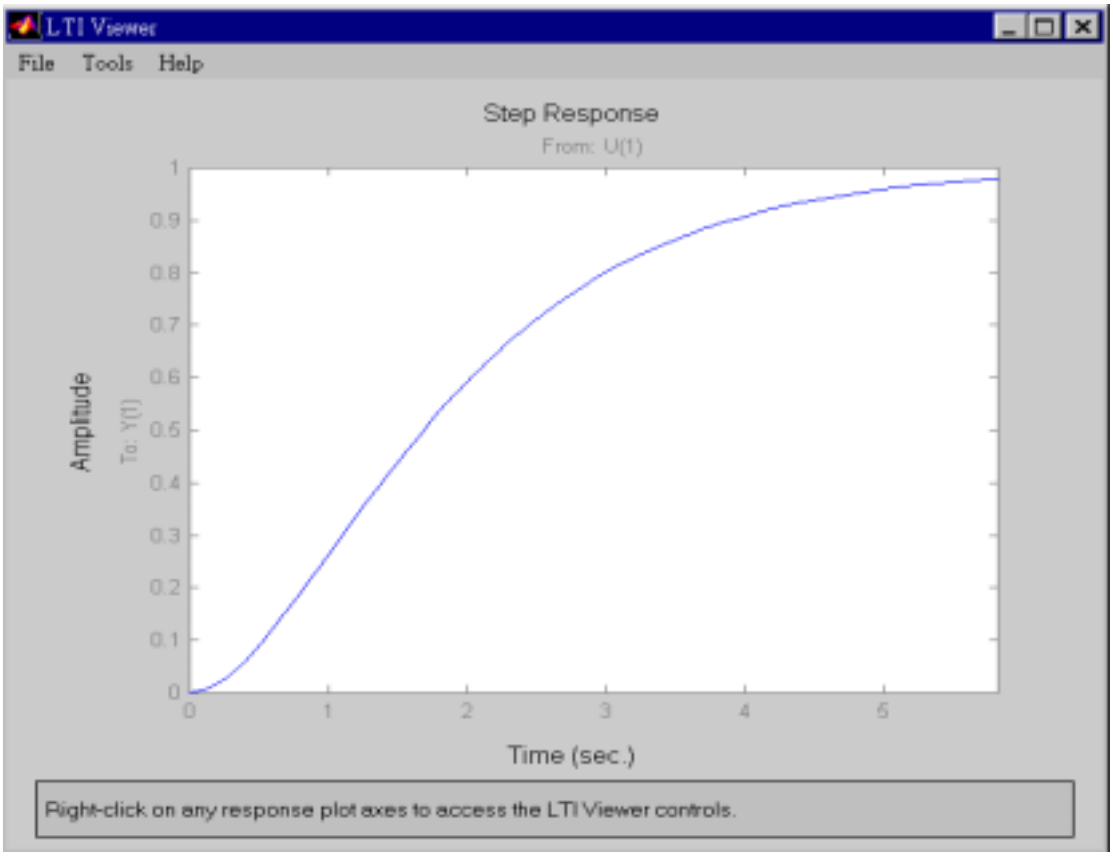
在 Matlab Command Window 輸入轉移函數



＊Select the LTI transfer functions for the LTI Viewer

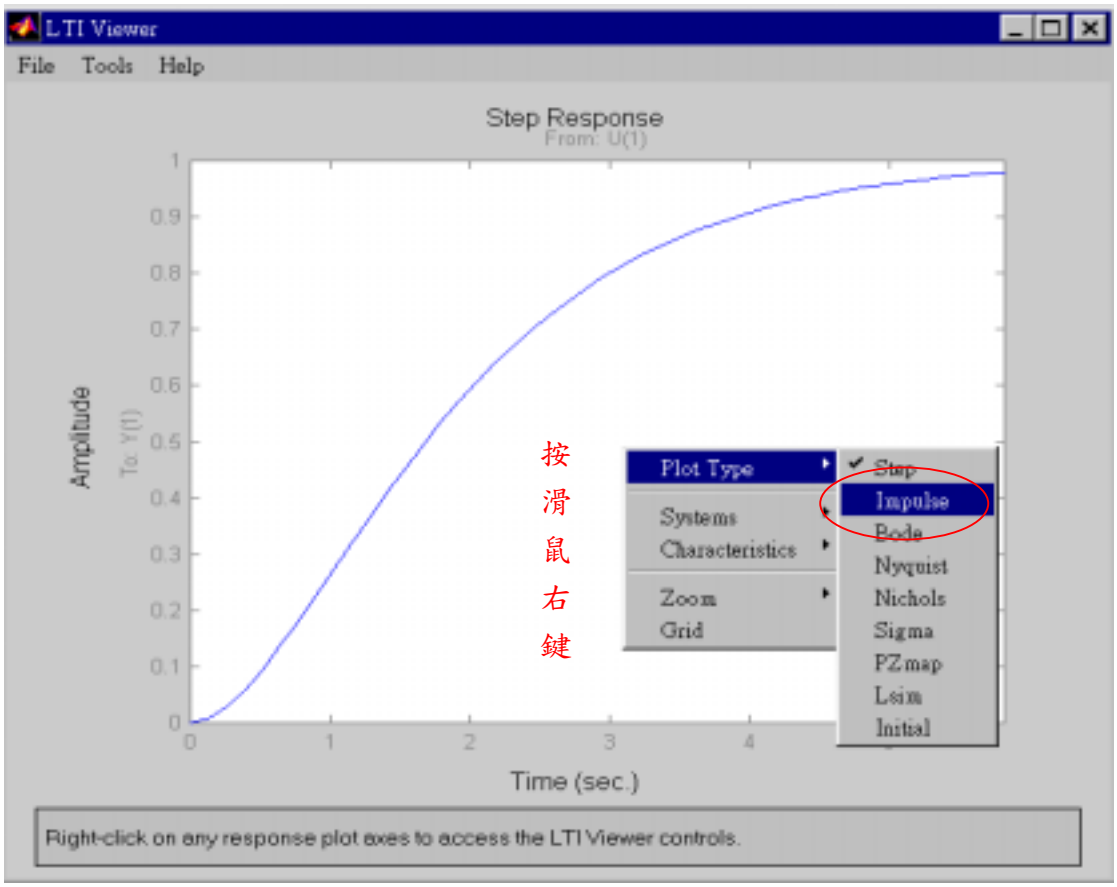


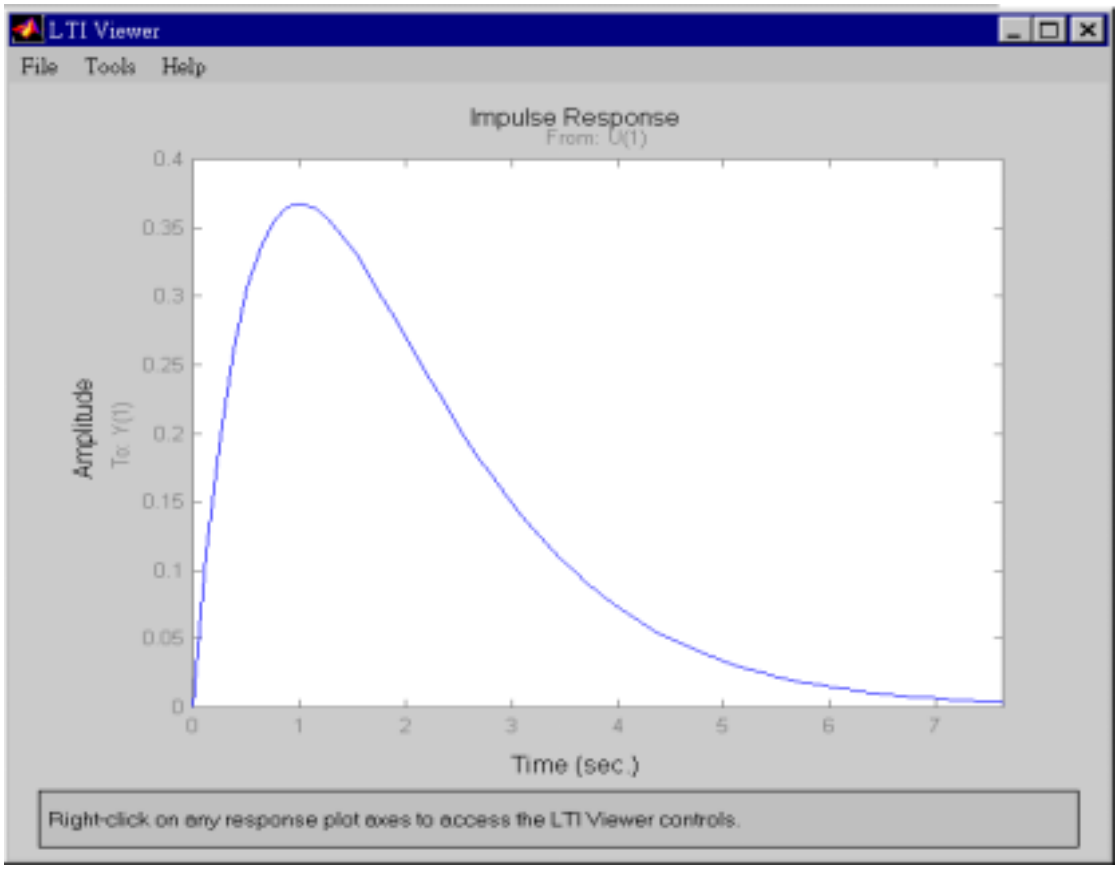




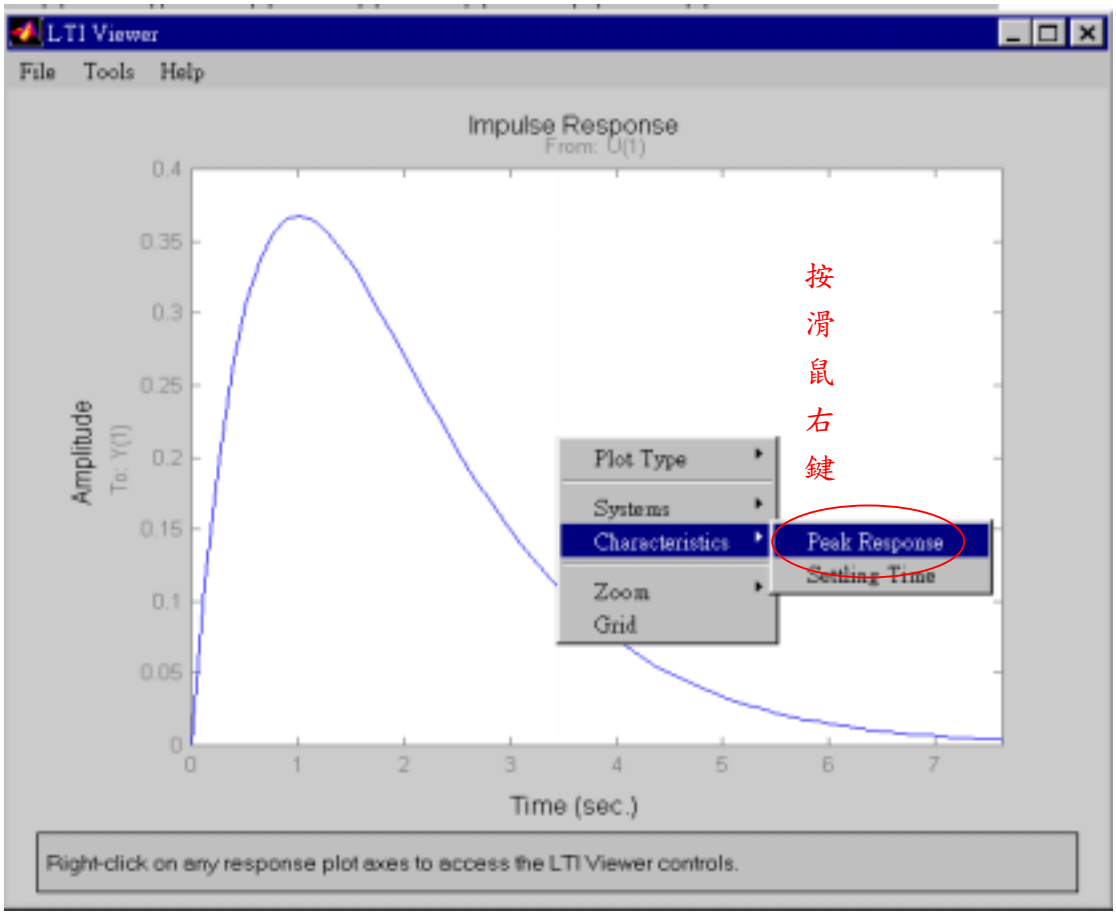
＊Select the plot type

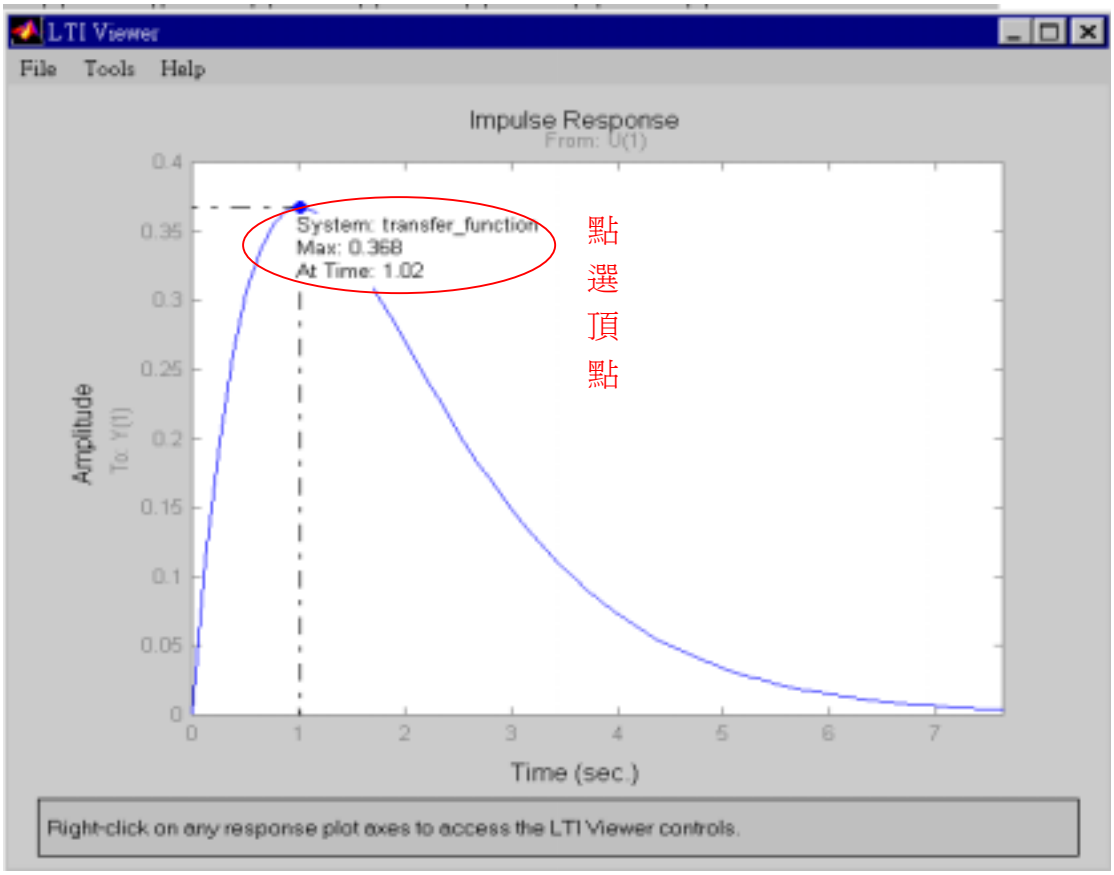
於 LTI Viewer 視窗按滑鼠右鍵

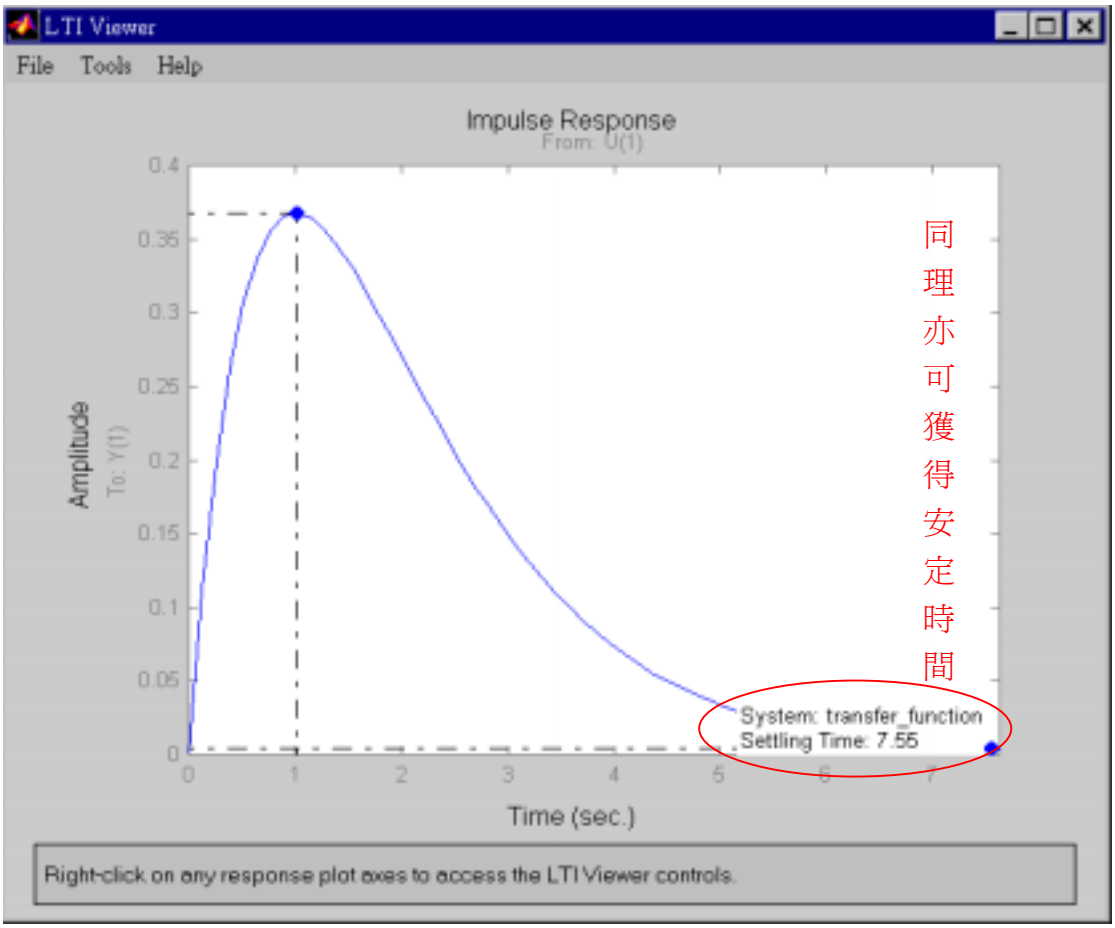




＊Select the characteristics




LTI Viewer
File Tools Help
Impulse Response
From: U(1)
System: transfer_function
Max: 0.368
At Time: 1.02
點選頂點
Amplitude
To: Y(1)
Time (sec.)
Right-click on any response plot axes to access the LTI Viewer controls.


LTI Viewer
File Tools Help
Impulse Response
From: U(1)
同理亦可獲得安定時間
System: transfer_function
Settling Time: 7.55
Amplitude
To: Y(1)
Time (sec.)
Right-click on any response plot axes to access the LTI Viewer controls.