# MATLAB基礎學習與應用

### 教學投影片

# Part 4 Simulink & DEE

# 【Q】如何進入Simulink

#### • step 1 進入Matlab

#### • step 2 方法一:在workspace输入simulink的指令。





• step 2 方法二:點選MATLAB 工具列之 📘

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#### • 如何利用SIMULINK解ODE

**Example1 :**  $x'_1 = -3x_1 + 2$ **Step1 :**  $x_1 = \int x'_1 dt$ 

在Library中點選Continuous,在Continuous中選取integrator,按住滑鼠

左鍵拖曳至untitled中,分別在各接點拉上連接線並標明各個涵義。



#### **Step1**: $x'_1 = -3x_1 + 2$

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#### (4) 從Sink中拖曳Scope至untitled中,並與連結

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#### (5)把Constant改為2,把Gain改為-3。

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#### (2) 調整適當的起始時間、結束時間和數值方法。

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#### (3) 點選Simulation/Start,開始模擬。

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#### (2) 按住滑鼠右鍵可重複複製一個Integrator

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#### (4) 在Integrator上按滑鼠兩次,給定 $x_1(0)=0$ , $x_2(0)=1$

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#### 【NOTE】(1)Simulink中外來的變數以u表示 (2)若函數太長,可把Fun邊框拉大則可顯示完整函數

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#### (4) 把各點連結起來即可完成 x'

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#### **Step3**: $x'_2 = -x_1x_2 + \cos(t)$

#### (1)從Math中拖曳Gain至untitled中,並複製一個Fun、Sum和Produc

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<b>Gain</b> : Element-wise gain ( $y = K$ . <sup>*</sup> u) or matrix gain ( $y = K^*u$ or $y = u^*K$ ).	
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#### (2) 修改Gain之值為-1; Fun1為 $\cos(u(1))$ (3) 把各點連結即可完成 $\frac{x'_2}{2}$

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Gain: Element-wise gain (y = K.*u) or m	
<ul> <li>Simulink</li> <li>Continuous</li> <li>Discrete</li> <li>Functions &amp; Tables</li> <li>Functions &amp; Tables</li> <li>Singlas &amp; Systems</li> <li>Sinks</li> <li>Sources</li> <li>Subsystems</li> <li>Communications Blockset</li> <li>Control System Toolbox</li> <li>DSP Blockset</li> <li>Developer's Kit for TI DSP</li> </ul>	
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#### (4) 從Sink中拖曳Scope並複製,使其接上 $x_1$ 、 $x_2$





#### (2) 調整適當的起始時間、結束時間和數值方法。

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#### (3) 顯示模擬的結果。



# 如何利用DEE解ODE \*如何進入DEE? (1)在Workspace輸入dee

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#### (3) 打開Simulink, 並把dee拖曳至untitled

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Name:方程式名稱 # of input:外界輸入變數的個數 =:微分方程式 x0:微分方程式的起始值 y=:解完方程式後之值 【NOTE】 (1)外界輸入變數以 <sub>x(</sub>表示 (2)微分方程式變數以 表示 (3)i表示個數

#### **Example1** : $x'_1 = -3x_1 + 2$

#### Step1:利用上述方法打開dee

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<b>Step2</b> :在的方框內輸入 -3x(1)+2	
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#### Step3:在的方框中輸入起始值0

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Step4:在 y= 的方框中輸入要	解的變數	
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# **Step5**:編輯完成之後,若最下方之Status為READY,則可按下右下角的Done;若無,則需重新檢查或編輯

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Step8:按下Simulation/Start開始模擬				
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#### Step9:顯示模擬結果



#### Example1 :

 $\begin{cases} x_1' = x_1 + x_2 e^{-t} \\ x_2' = -x_1 x_2 + \cos(t) \end{cases}$ 

 $x_1(0) = 0$   $x_2(0) = 1$ 

#### **Step1**:利用上述方法打開dee

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#### Step2:因為t為外界輸入所以在# of input的方框中輸入1

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#### Step3:在的方框內輸入聯立方程式 Step4:在的方框中輸入起始值0,1

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#### Step6:按下Done即编輯完成DEE

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#### Step9:調整Simulation/Parameters中之時間和數值方法

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#### Step10:按下Simulation/Start開始模擬

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#### Step11:顯示模擬結果



#### Step1:從Signals&Systems中拖曳Mux至untitled中,並把各點連結 起來

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Mux: Multiplex scalar, vector, or matrix signals into a bus.		
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#### Step2:重複Step9~Step11則其結果如以下所示

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Ready 100% ode45 Time offset: 0	
	►
Ready	