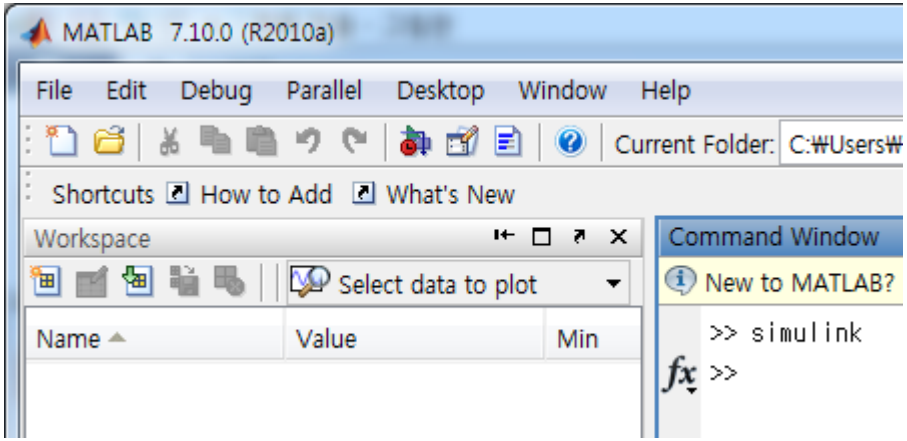
MATLAB 기초

-Simulink

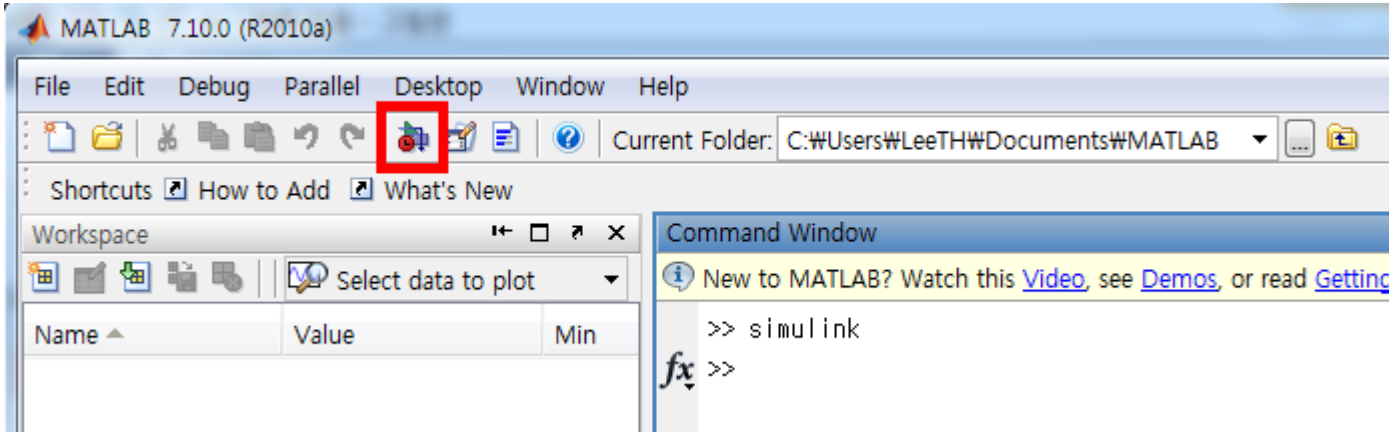
전북대학교 전자공학부
이태희

Simulink 시작하기

- Command Window창에 simulink 입력 후 엔터 또는

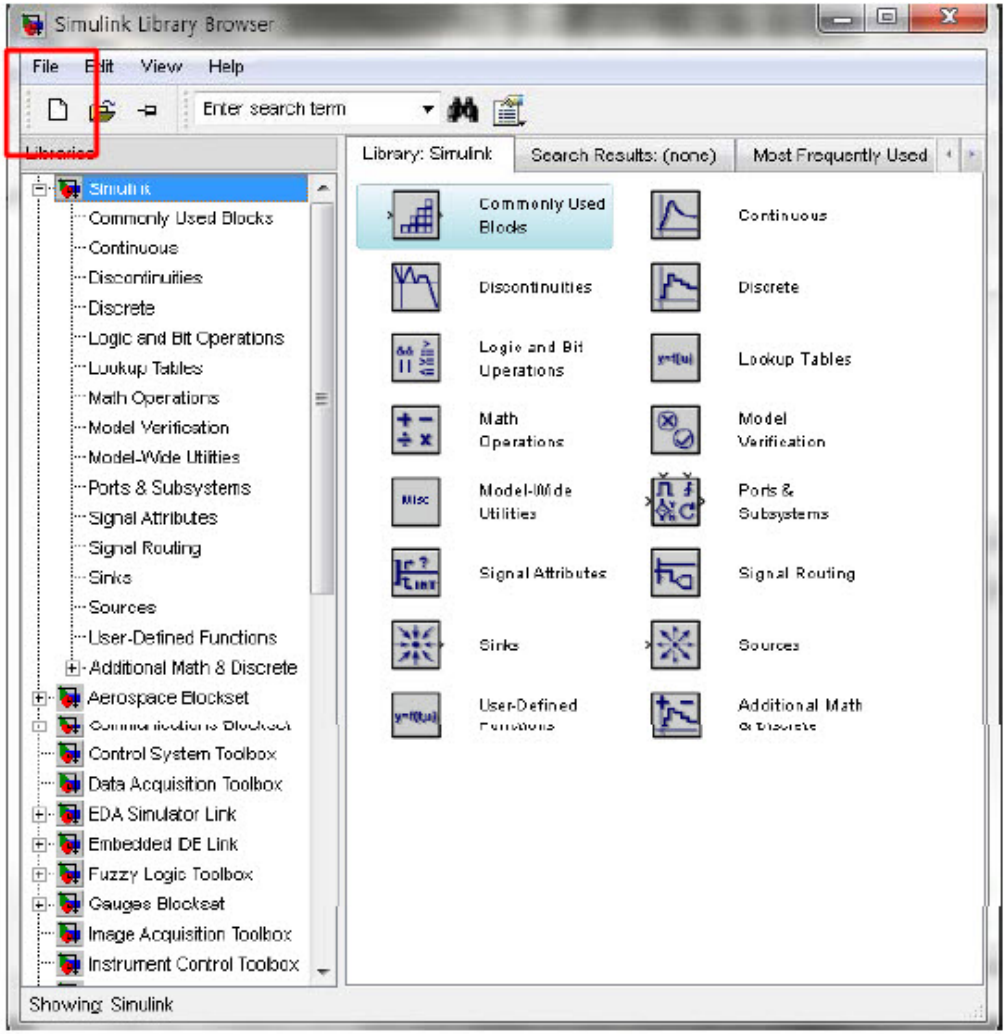


- 아래의 아이콘을 누른다



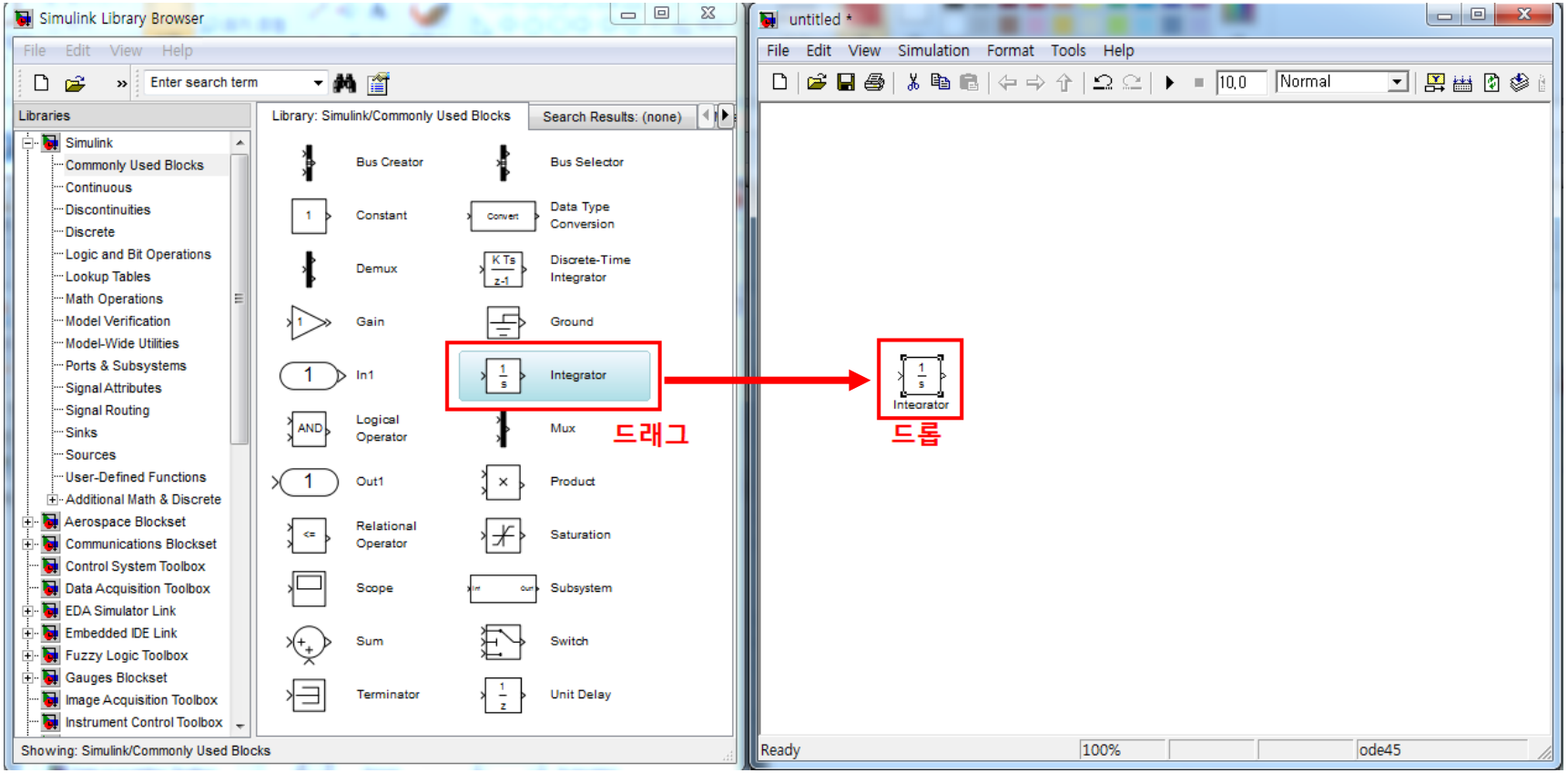
Simulink 시작하기

- Simulink 아이콘들이 모여있는 Simulink Library가 나타난다.
- 아래의 아이콘을 클릭하면

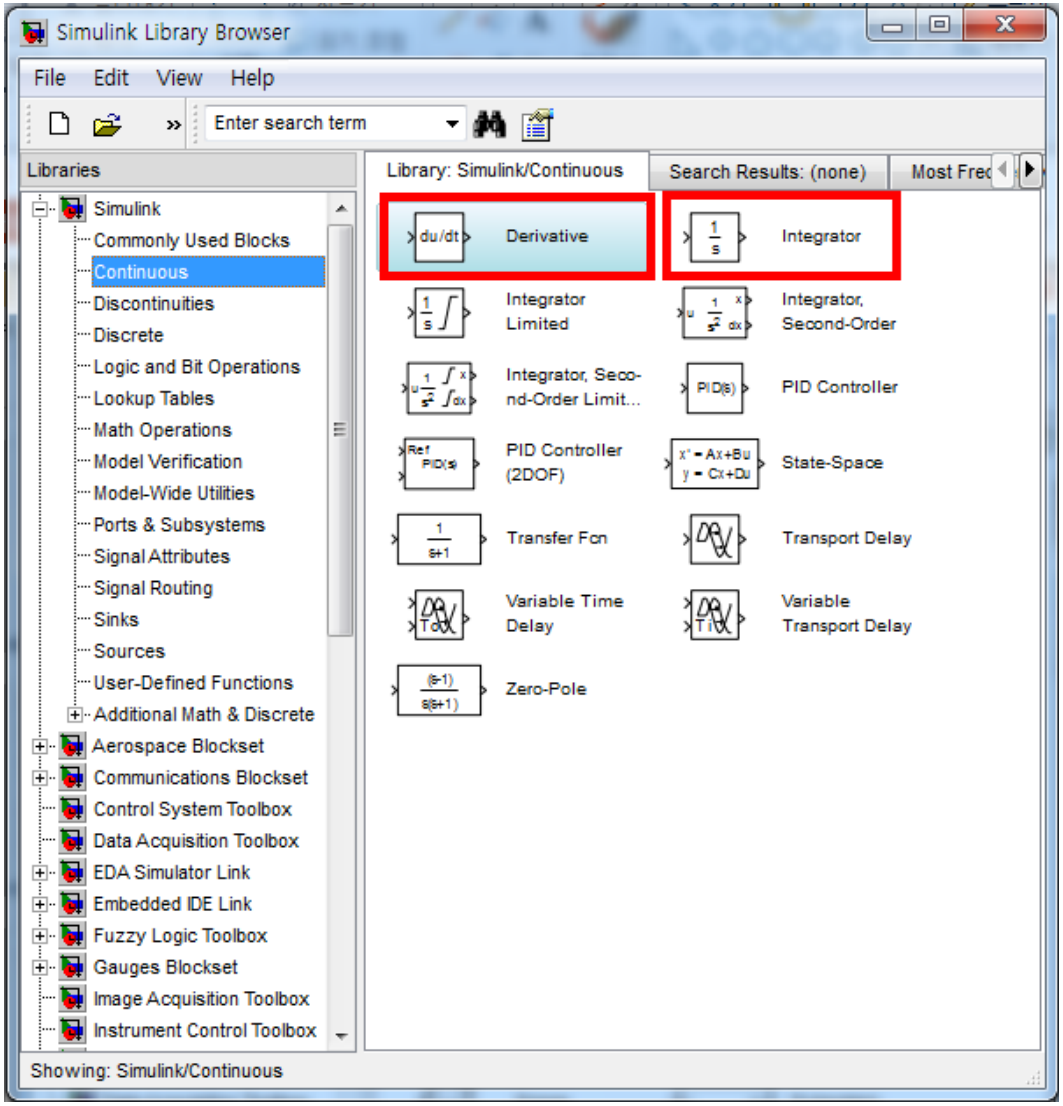


Simulink 시작하기

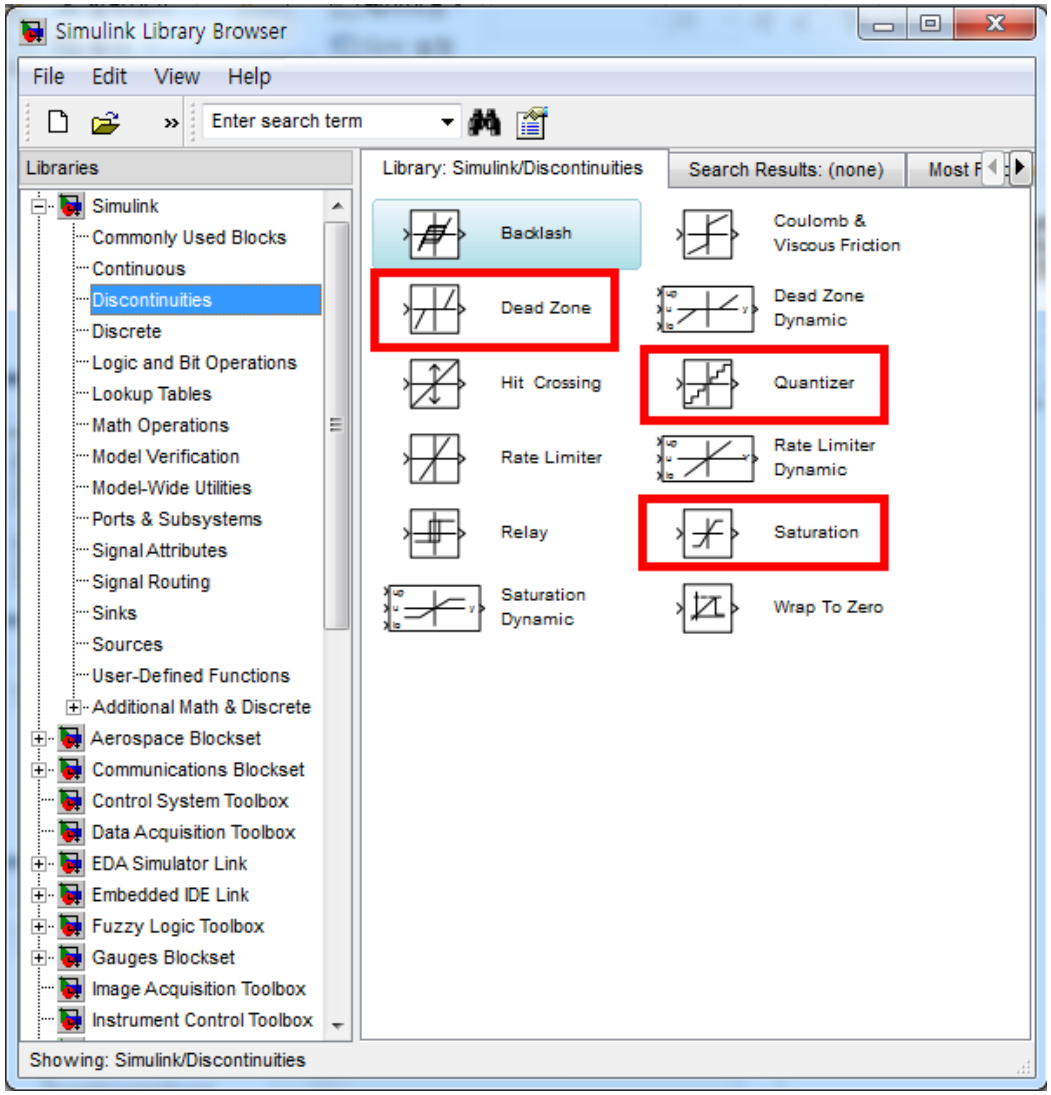
- 아래의 Simulink 작성을 위한 새 창이 열린다.
- 기본적으로 Simulink 파일은 Simulink Library의 아이콘을 작업창으로 드래그 하여 작성하게 된다.



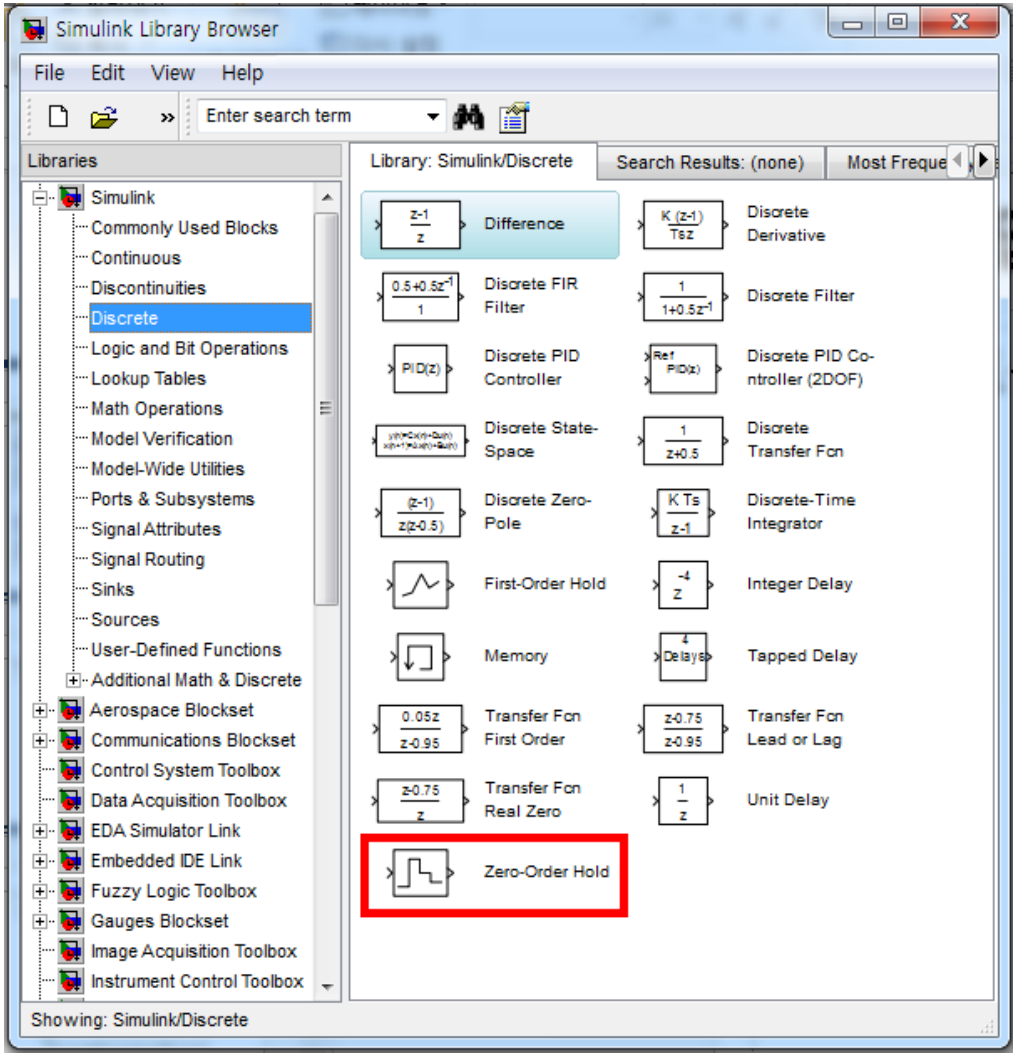
Simulink Library



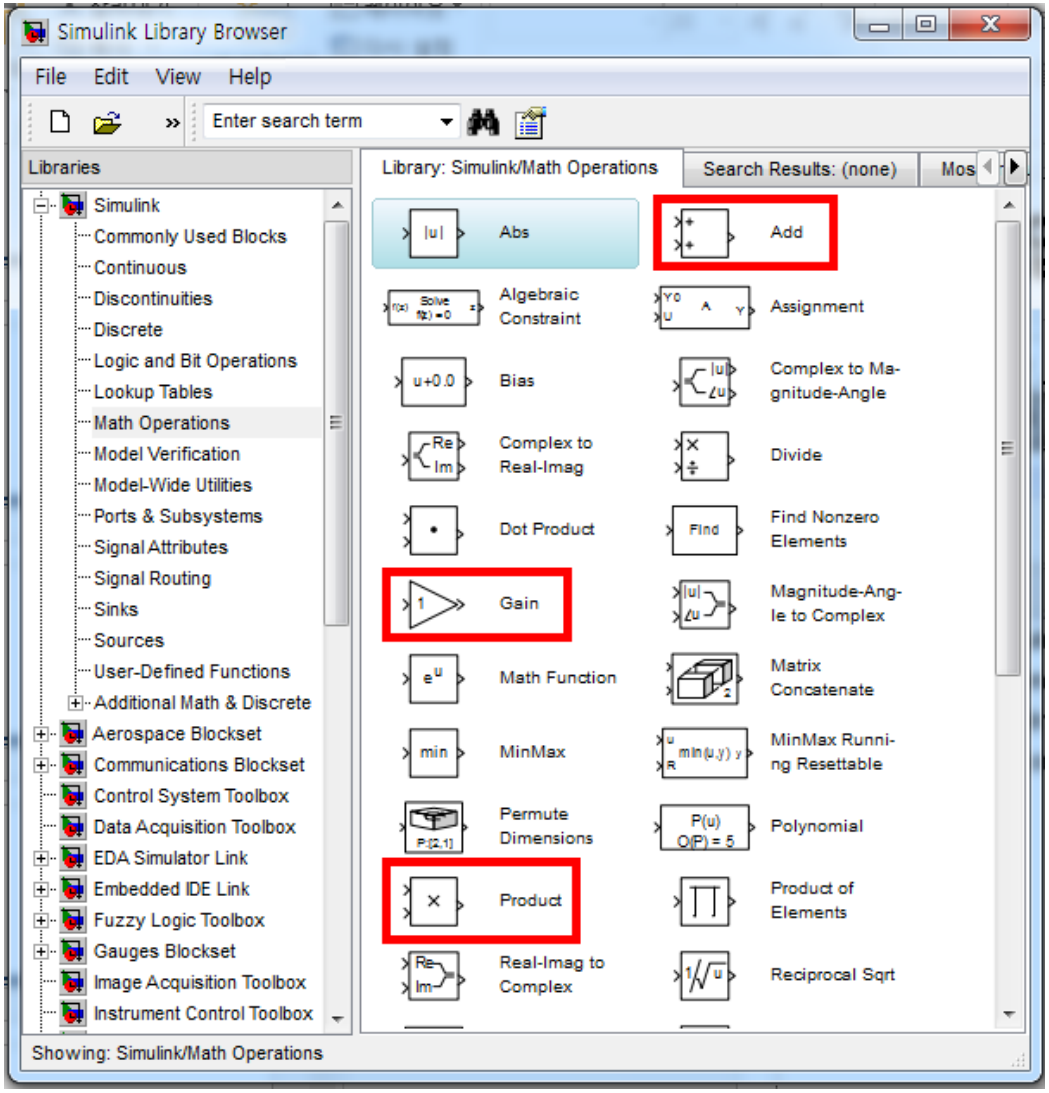
Simulink Library



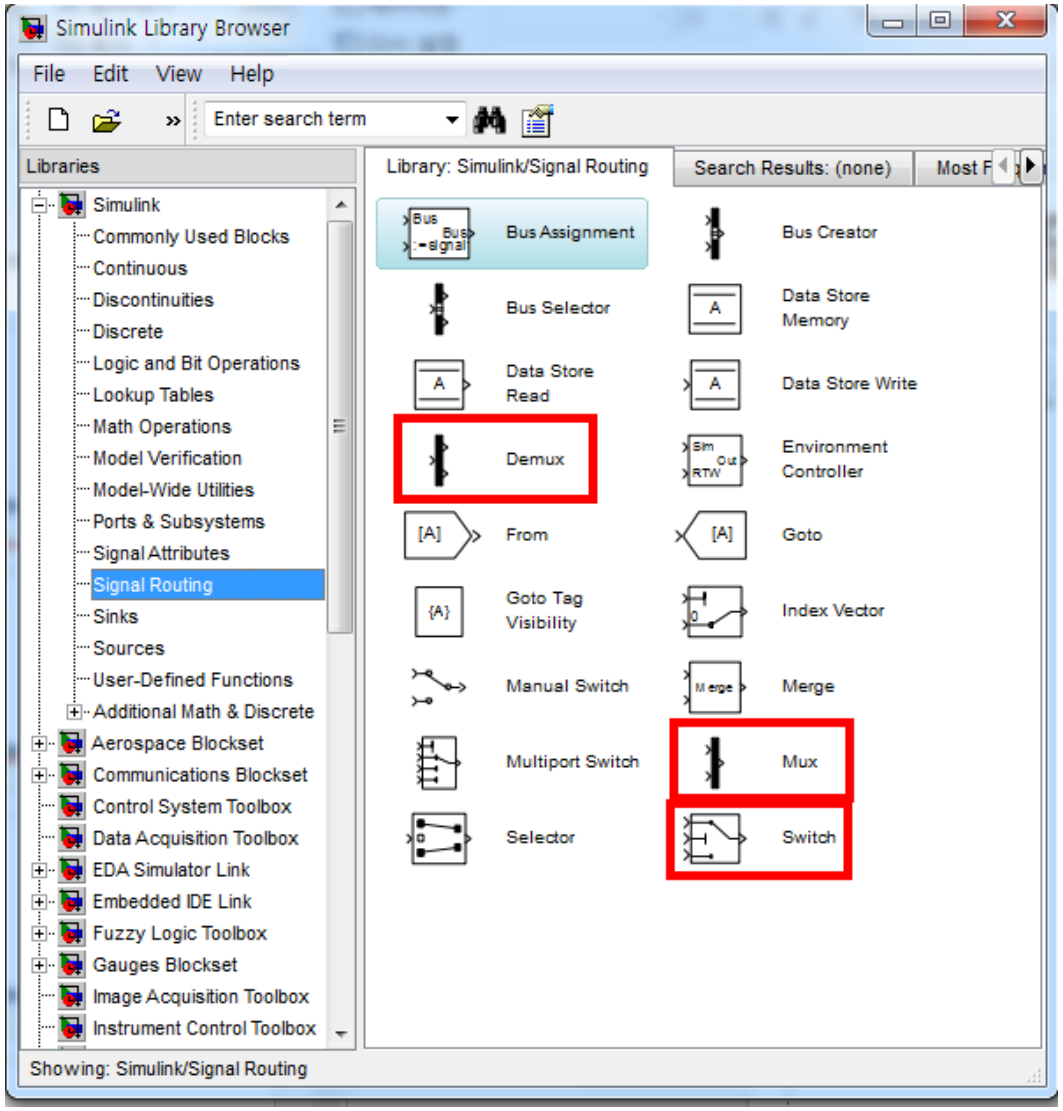
Simulink Library



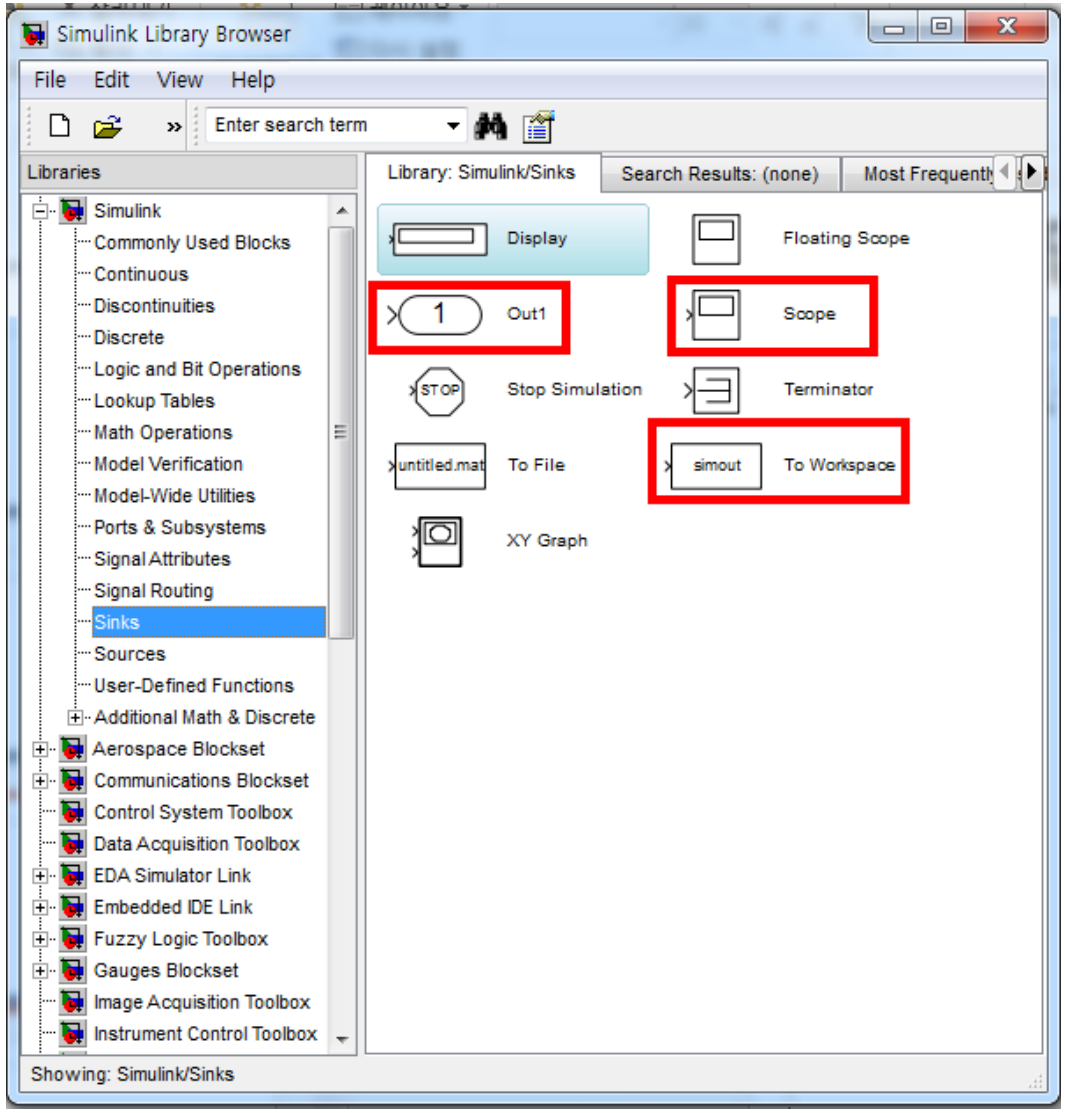
Simulink Library



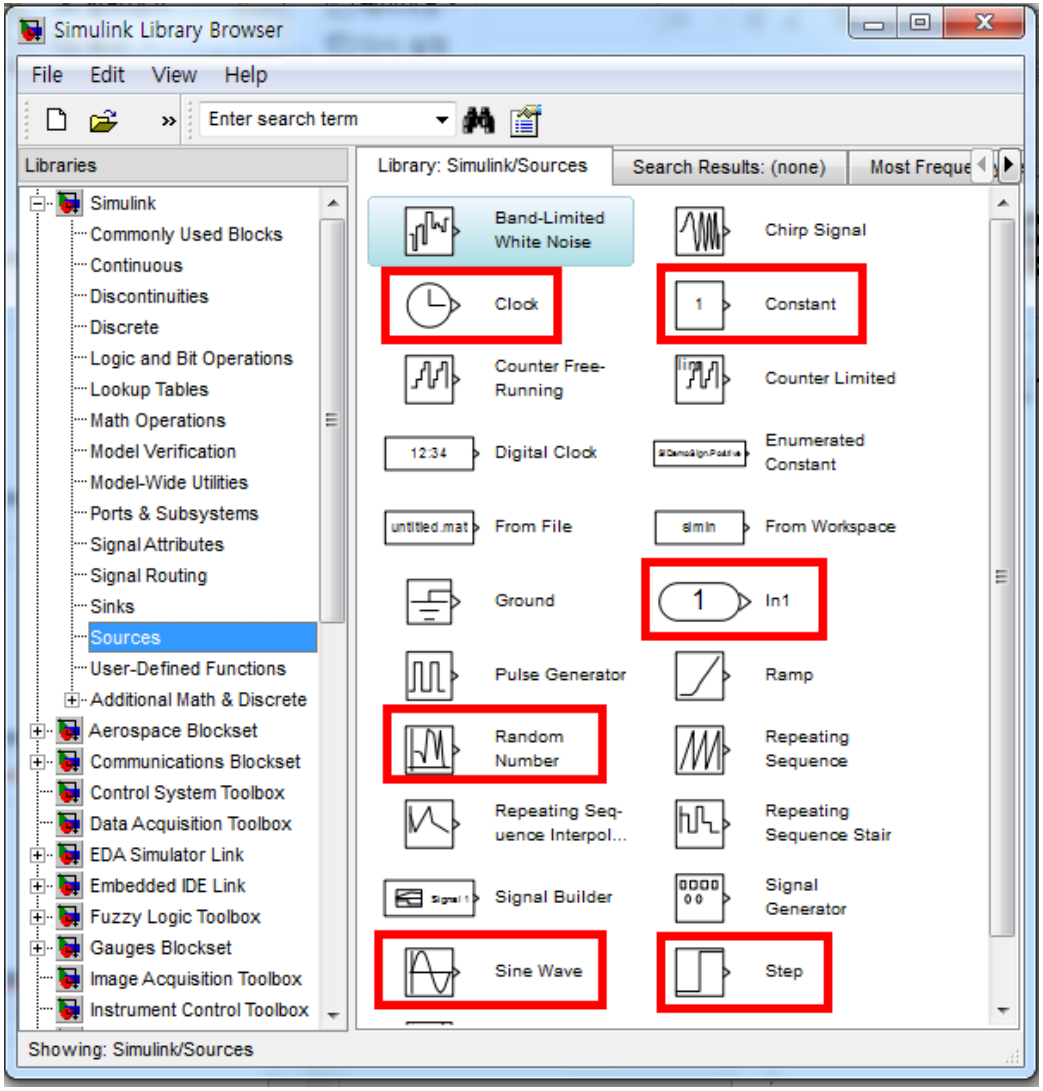
Simulink Library



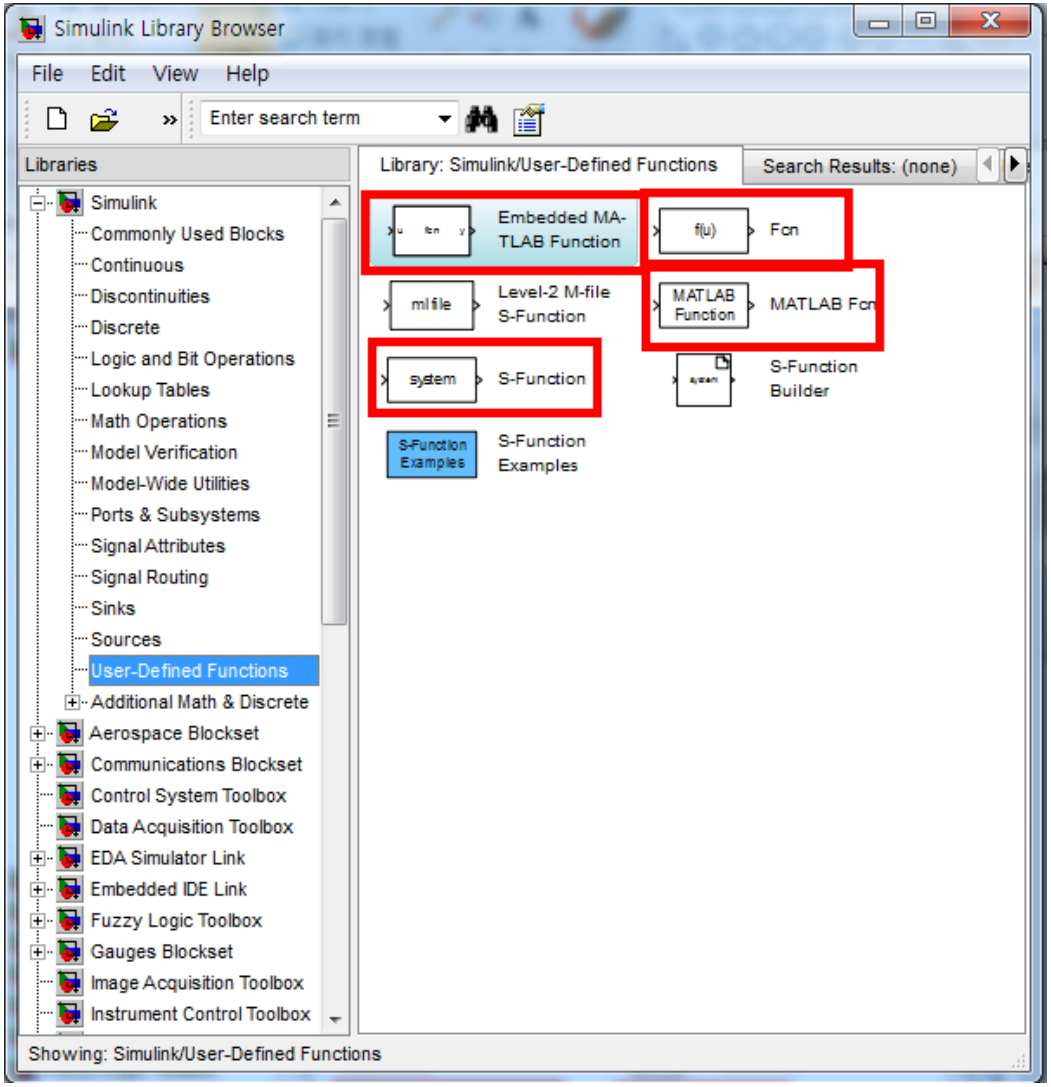
Simulink Library



Simulink Library

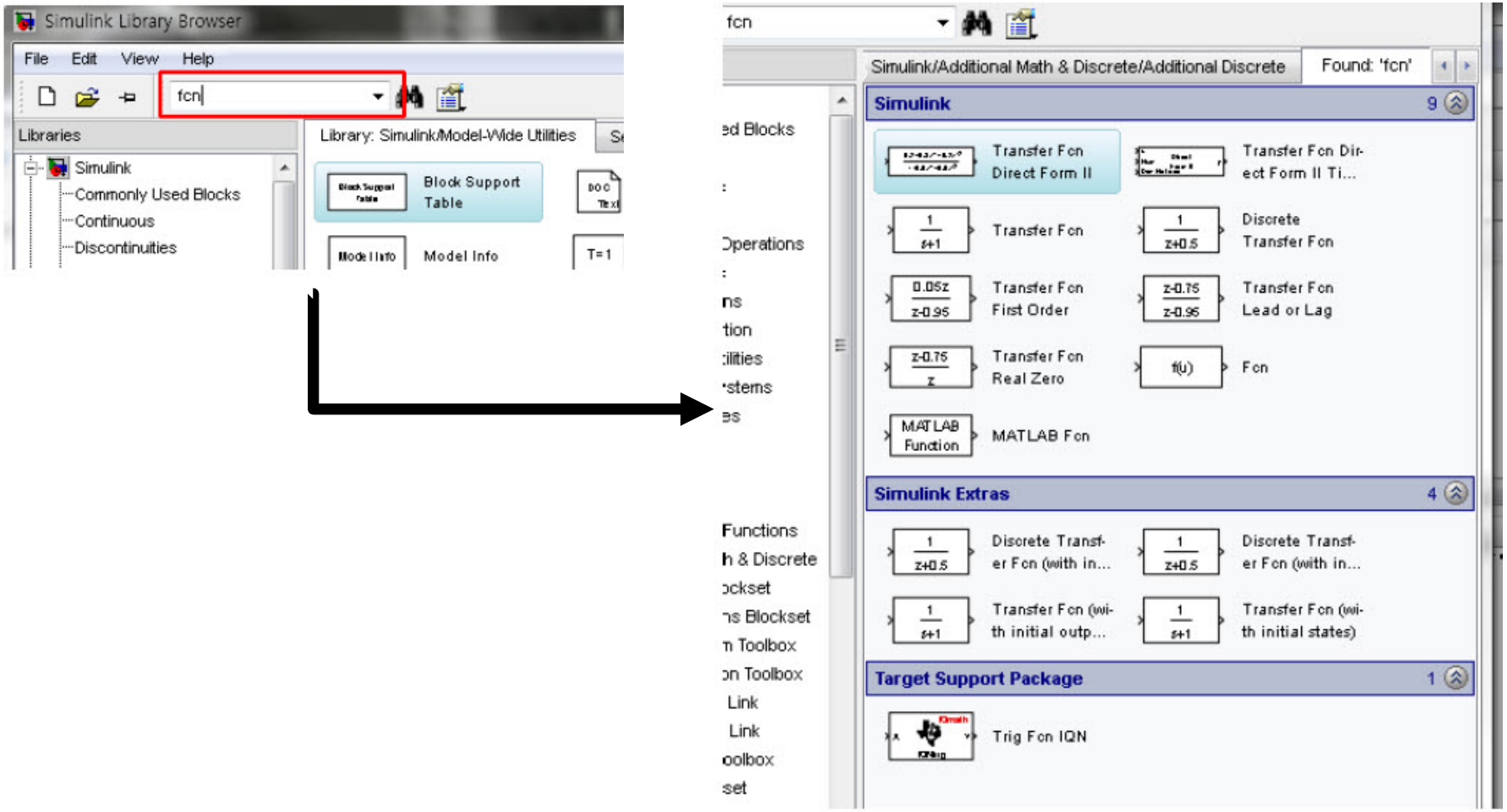


Simulink Library



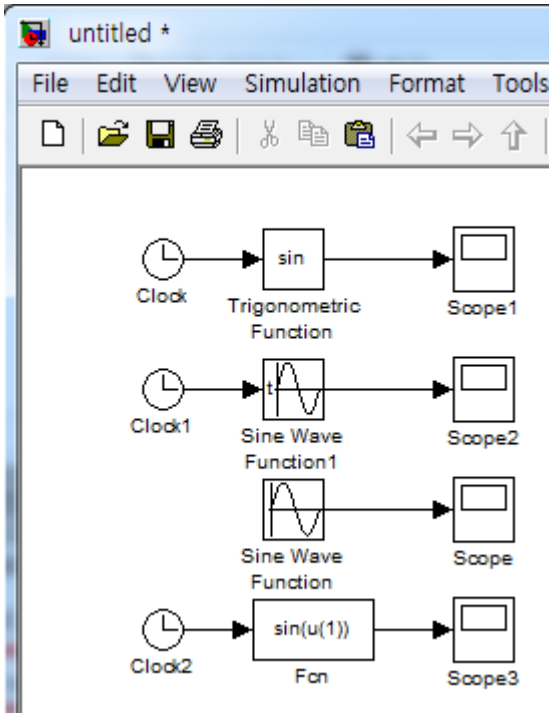
Simulink Library

- 아이콘 찾기



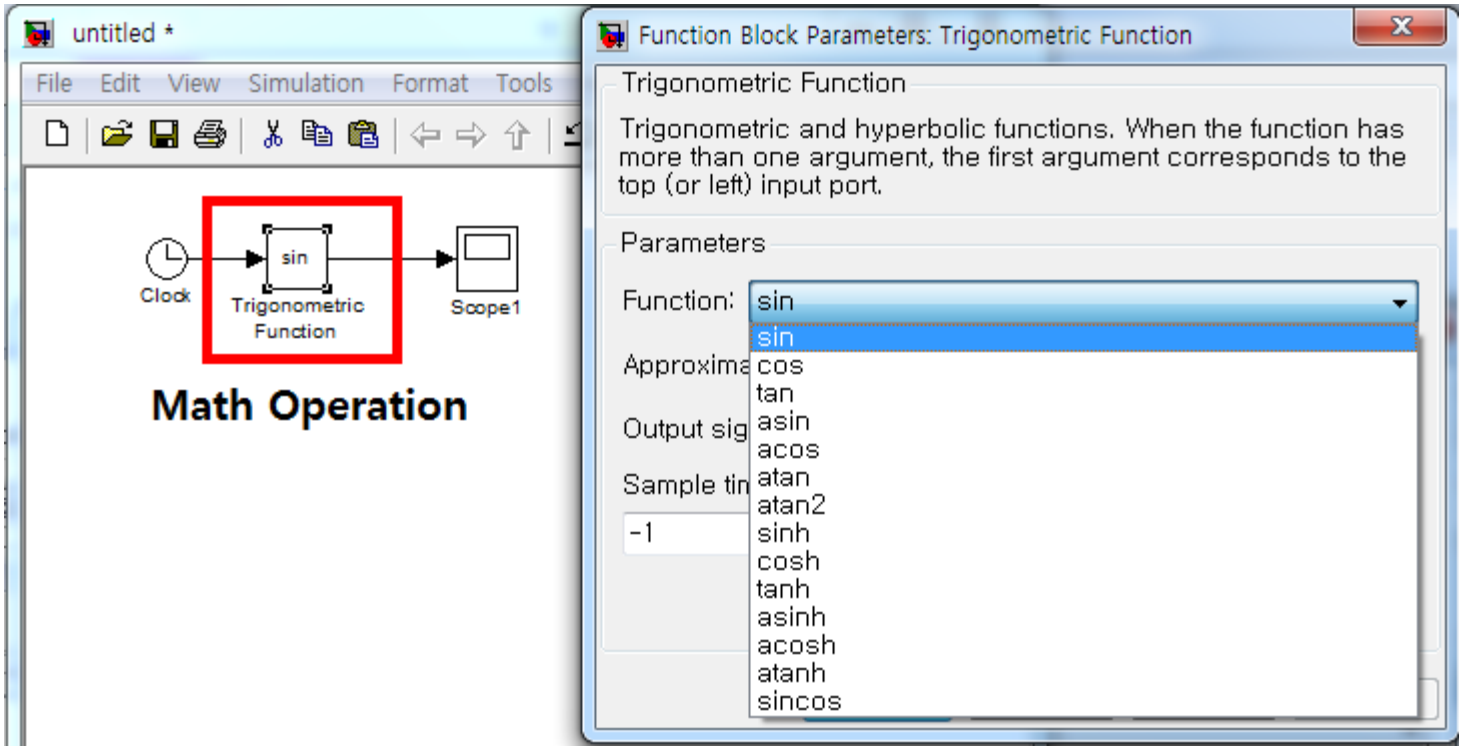
기본예제

- $\sin t$ 의 그래프를 그려보자



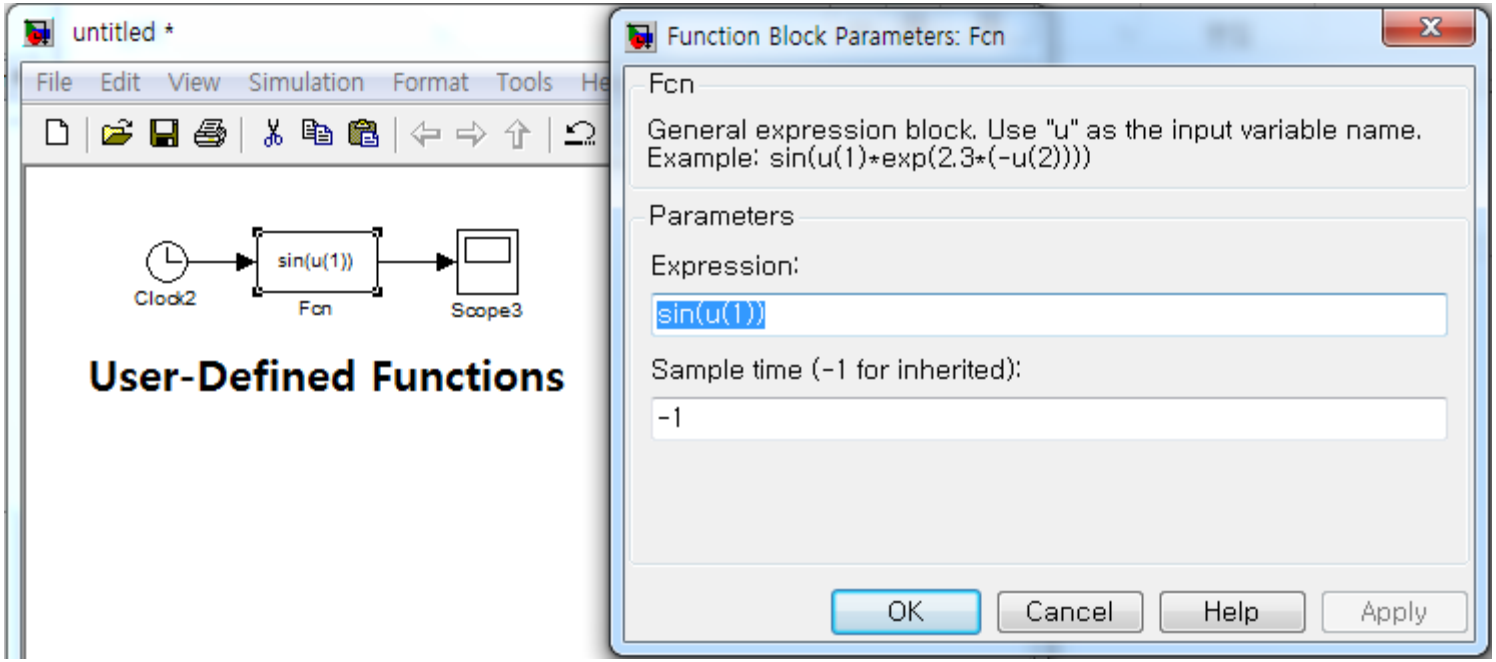
기본예제

- $\sin t$ 의 그래프를 그려보자



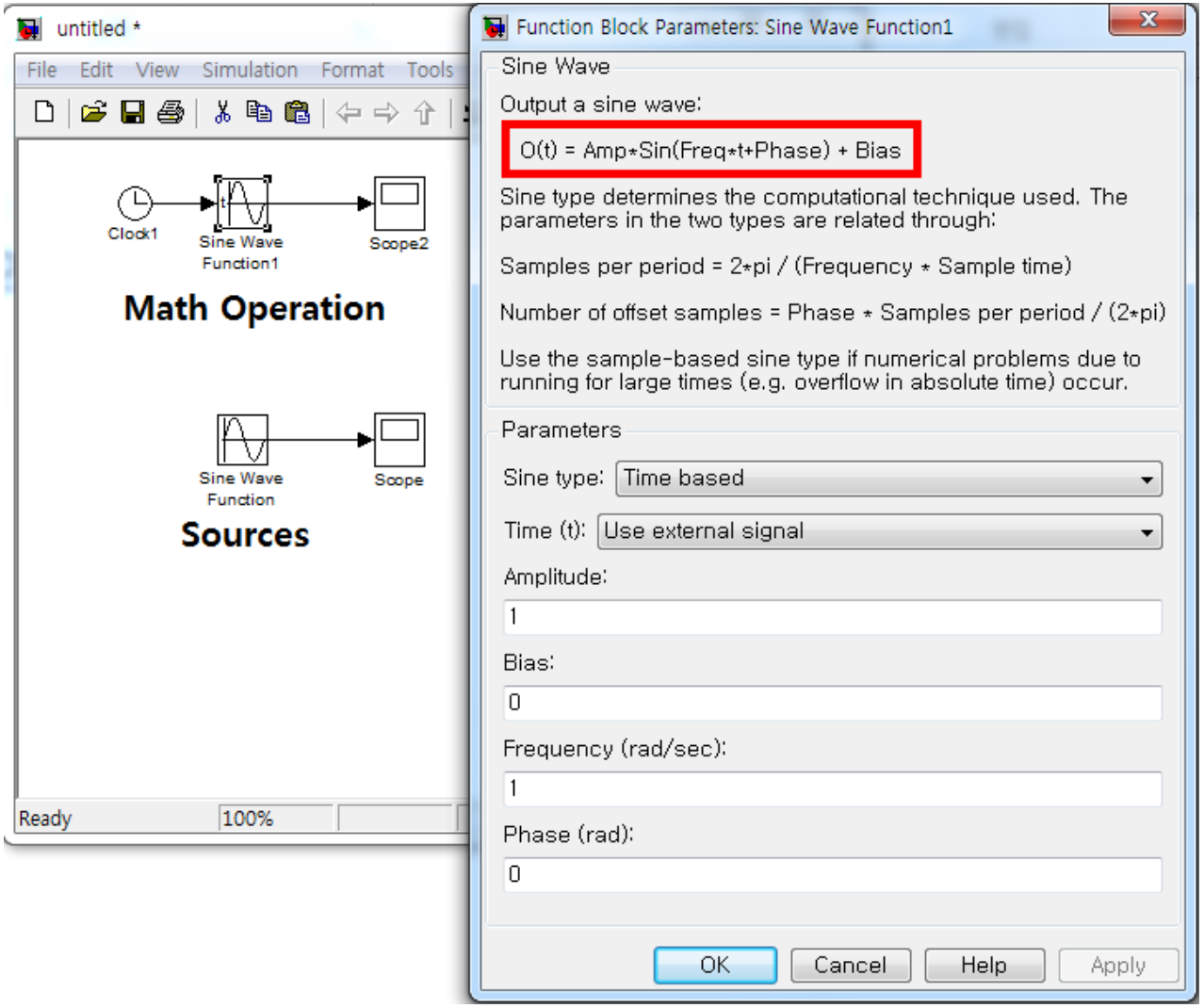
기본예제

- $\sin t$ 의 그래프를 그려보자

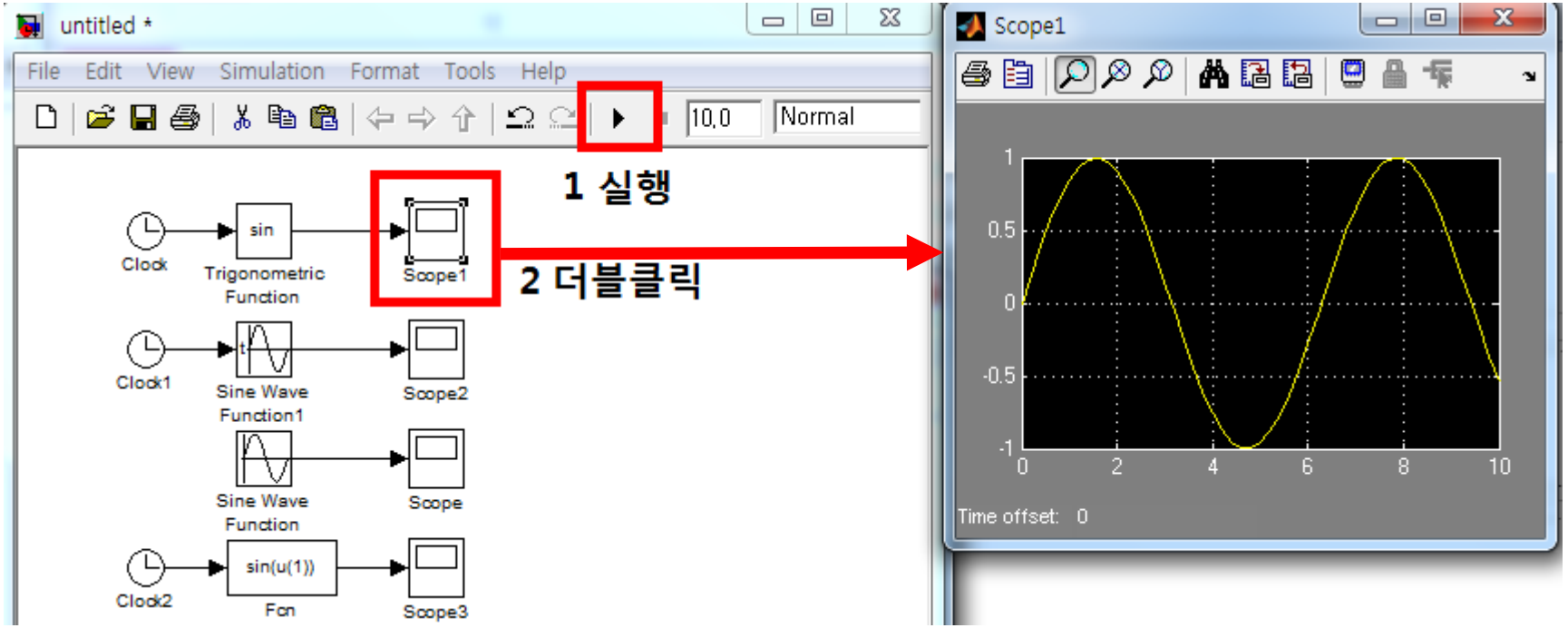


기본예제

- $\sin t$ 의 그래프를 그려보자

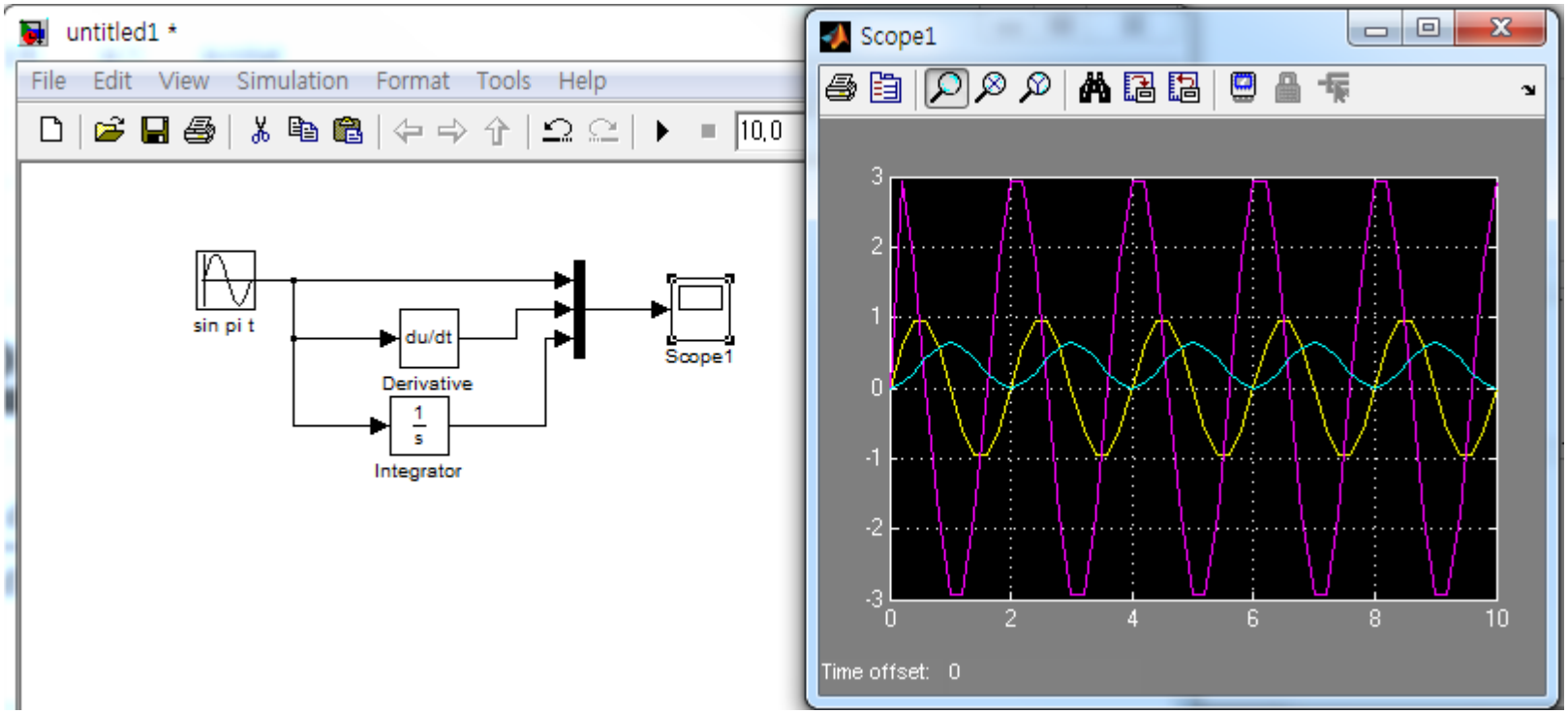


기본예제


untitled *
File Edit View Simulation Format Tools Help
10.0
Normal
1 실행
2 더블클릭
Clock
sin
Trigonometric Function
Scope1
Clock1
Sine Wave Function1
Scope2
Sine Wave Function
Scope
Clock2
sin(u(1))
Fcn
Scope3
Scope1
1
0.5
0
-0.5
-1
0
2
4
6
8
10
Time offset: 0

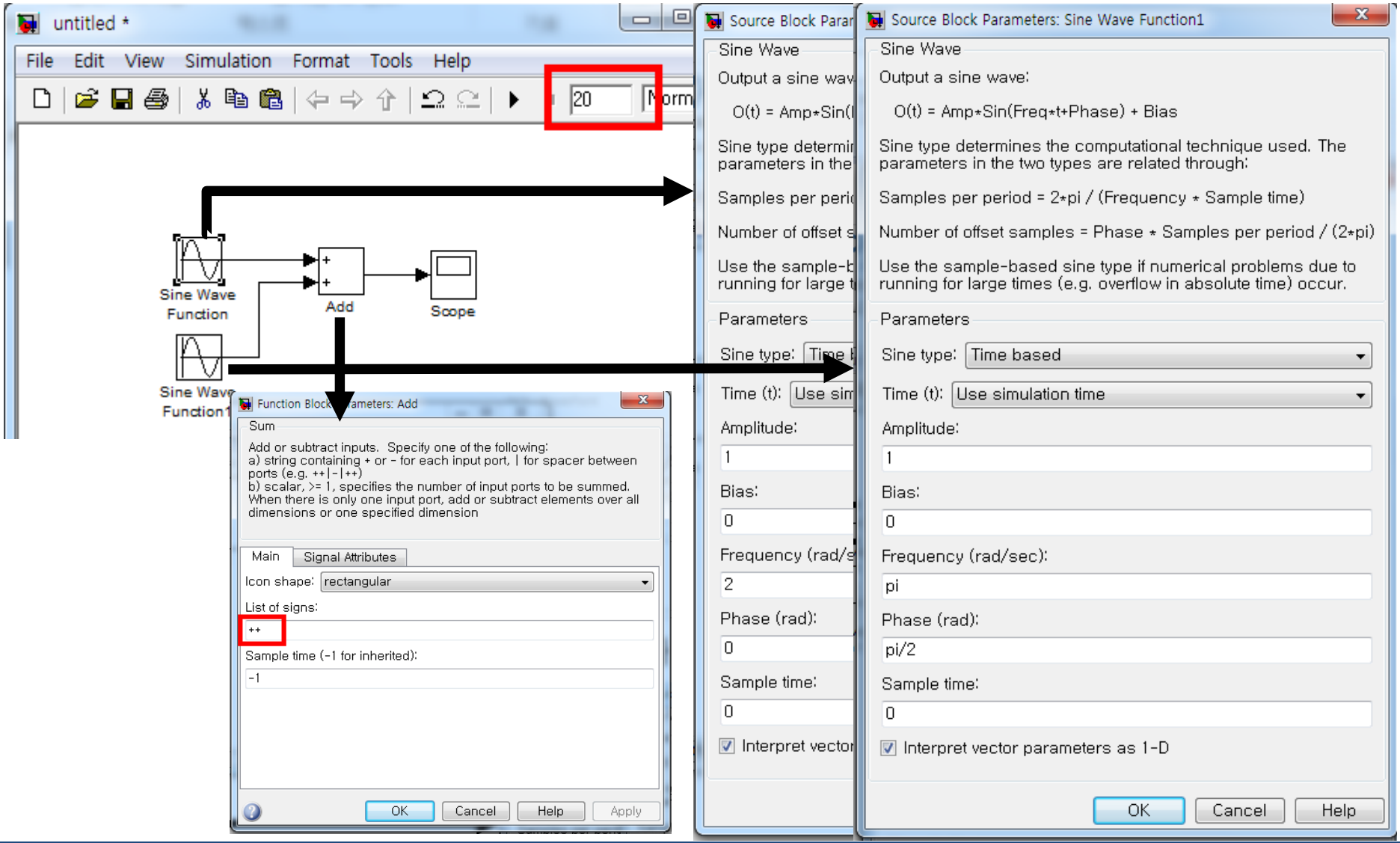
Mux 아이콘

- $\sin \pi t, \frac{d}{dt} \sin \pi t, \int \sin \pi t \, dt$ 를 한 화면에 그려보자.

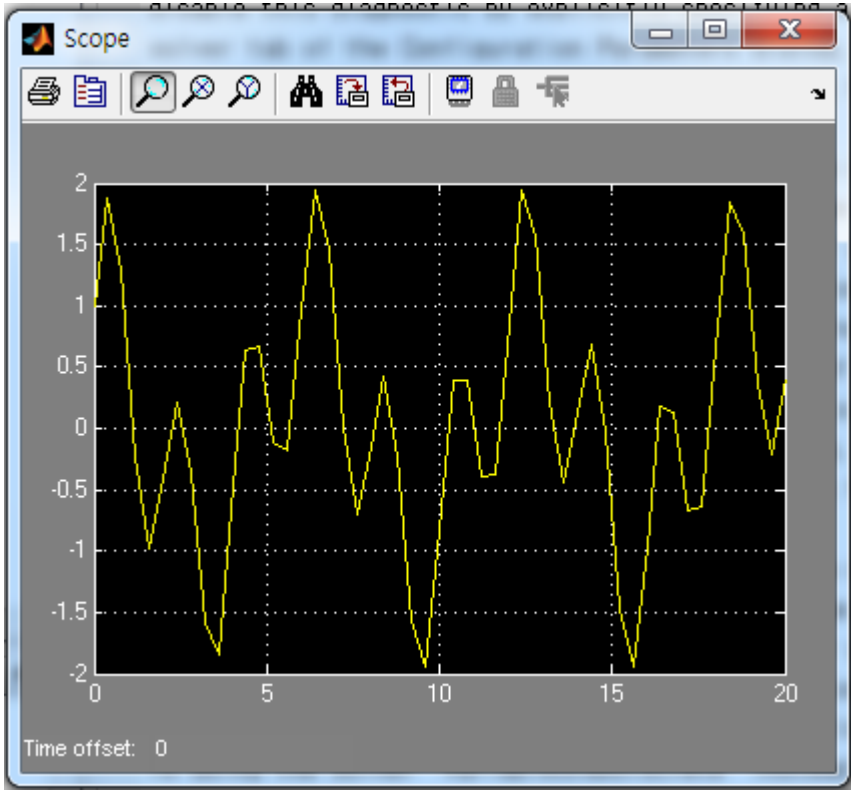


Sin 과 Add 아이콘

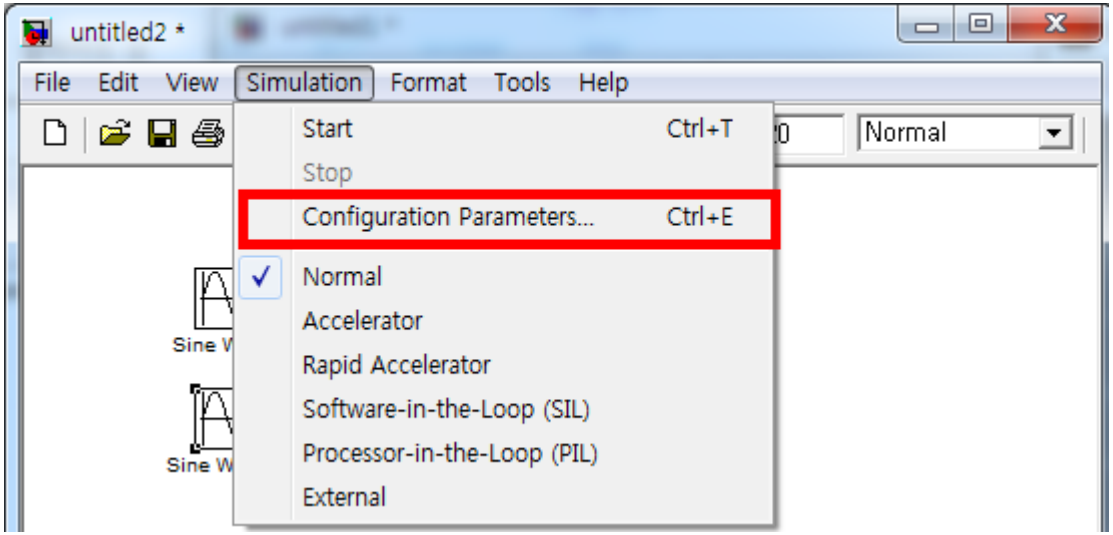
- $\sin 2t + \cos \pi t$ 의 그래프를 0~20초까지 그려보자.



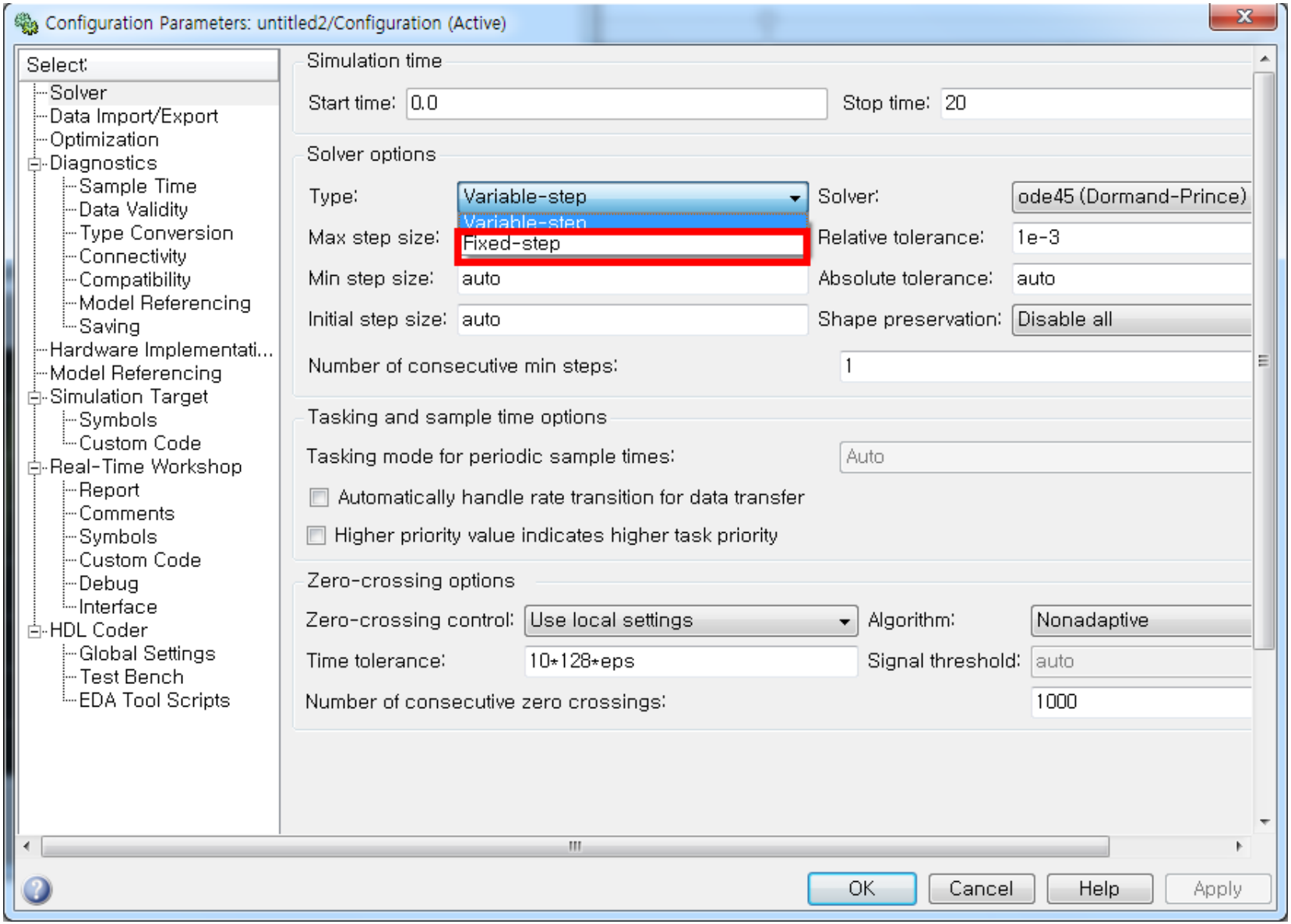
Sin 과 Add 아이콘



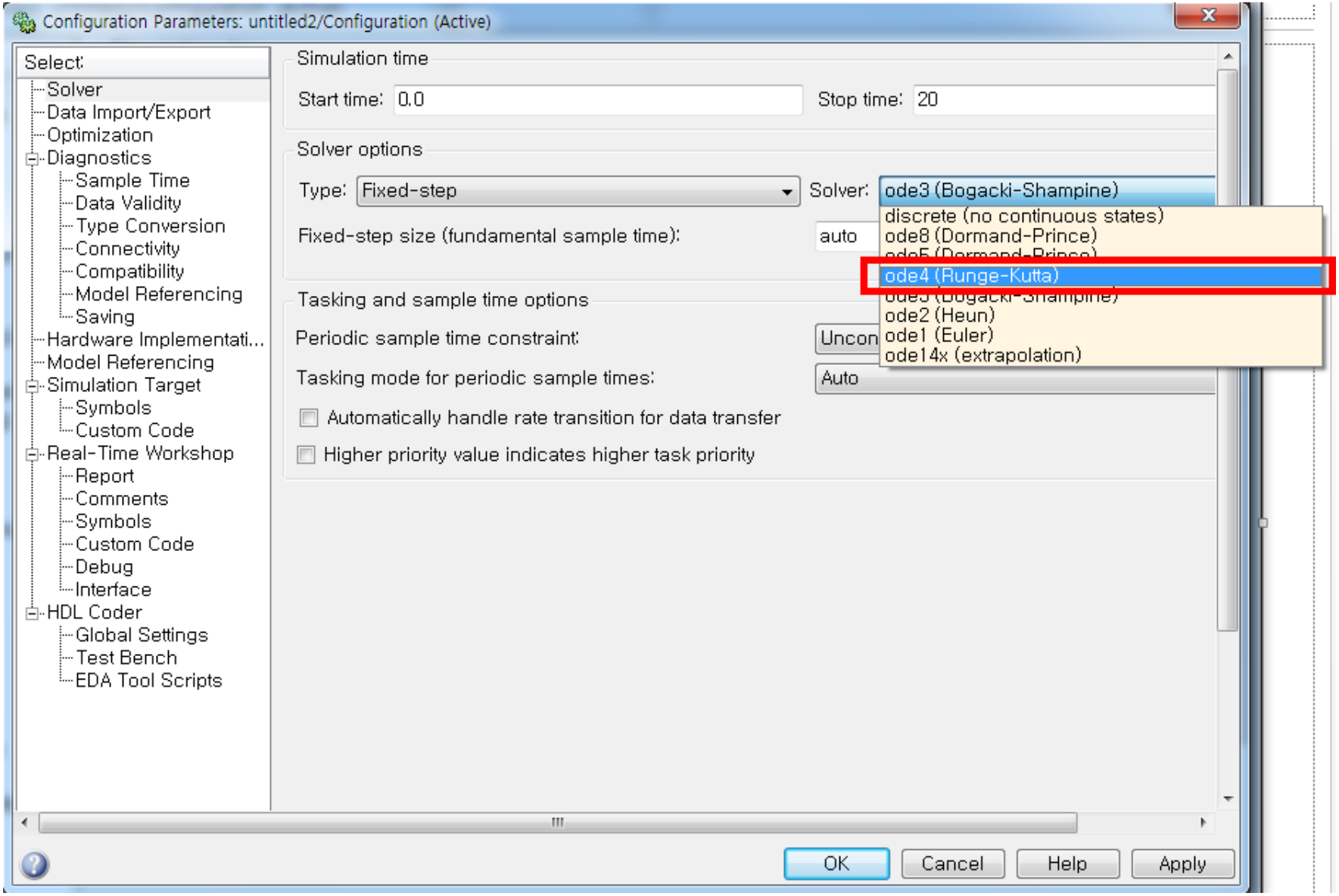
시스템 파라메터 설정


untitled2 *
File
Edit
View
Simulation
Format
Tools
Help
Normal
Start Ctrl+T
Stop
Configuration Parameters... Ctrl+E
Normal
Accelerator
Rapid Accelerator
Software-in-the-Loop (SIL)
Processor-in-the-Loop (PIL)
External
Sine W
Sine W

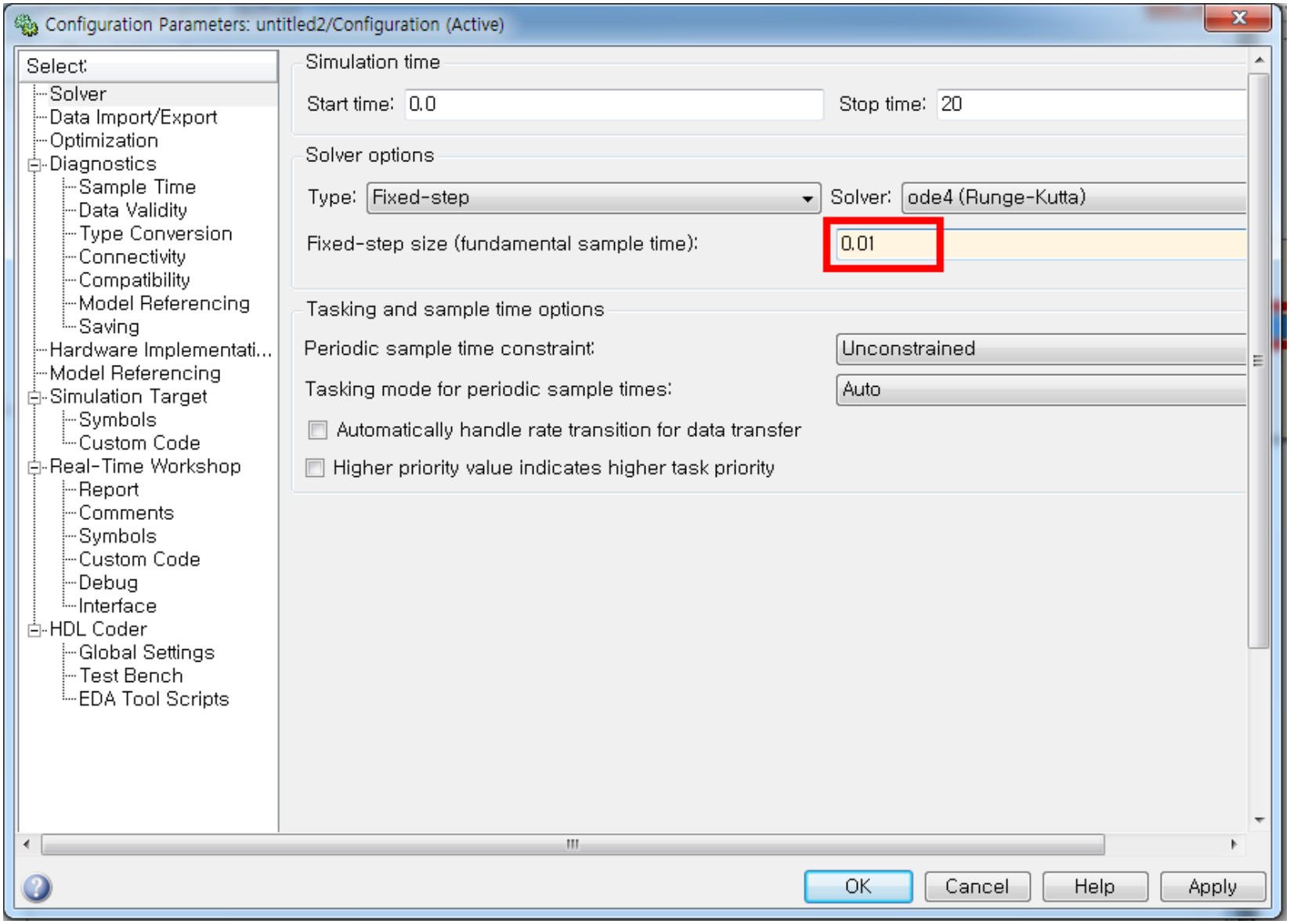
시스템 파라메터 설정


Configuration Parameters: untitled2/Configuration (Active)
Select:
Solver
Data Import/Export
Optimization
Diagnostics
Sample Time
Data Validity
Type Conversion
Connectivity
Compatibility
Model Referencing
Saving
Hardware Implementati...
Model Referencing
Simulation Target
Symbols
Custom Code
Real-Time Workshop
Report
Comments
Symbols
Custom Code
Debug
Interface
HDL Coder
Global Settings
Test Bench
EDA Tool Scripts
Simulation time
Start time: 0.0
Stop time: 20
Solver options
Type: Variable-step
Variable-step
Fixed-step
Solver: ode45 (Dormand-Prince)
Max step size:
Relative tolerance: 1e-3
Min step size: auto
Absolute tolerance: auto
Initial step size: auto
Shape preservation: Disable all
Number of consecutive min steps: 1
Tasking and sample time options
Tasking mode for periodic sample times: Auto
Automatically handle rate transition for data transfer
Higher priority value indicates higher task priority
Zero-crossing options
Zero-crossing control: Use local settings
Algorithm: Nonadaptive
Time tolerance: 10*128*eps
Signal threshold: auto
Number of consecutive zero crossings: 1000
OK
Cancel
Help
Apply

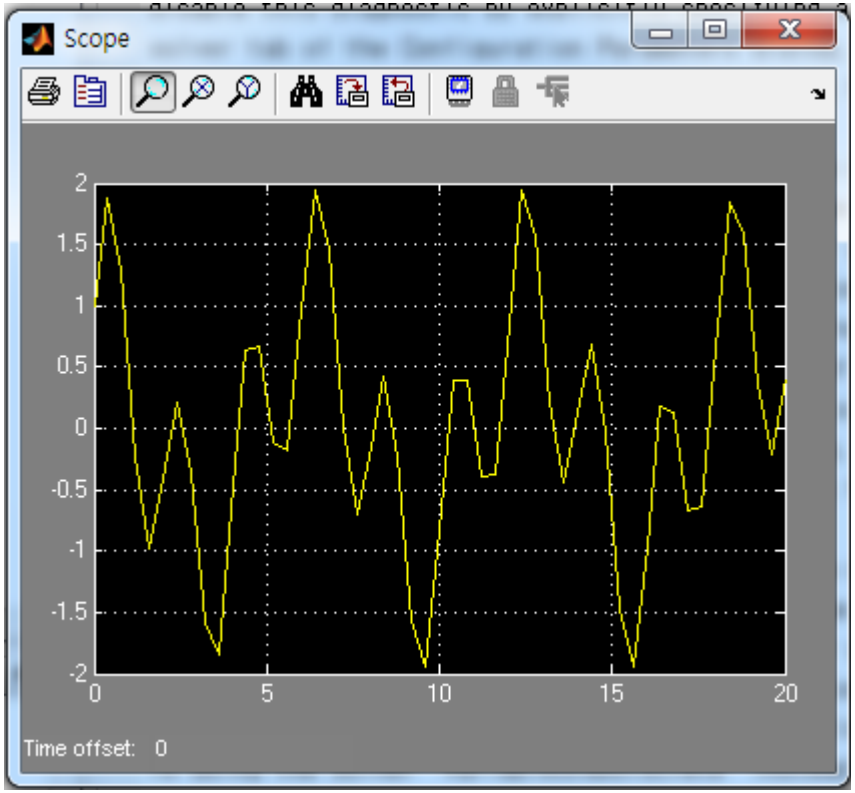
시스템 파라메터 설정

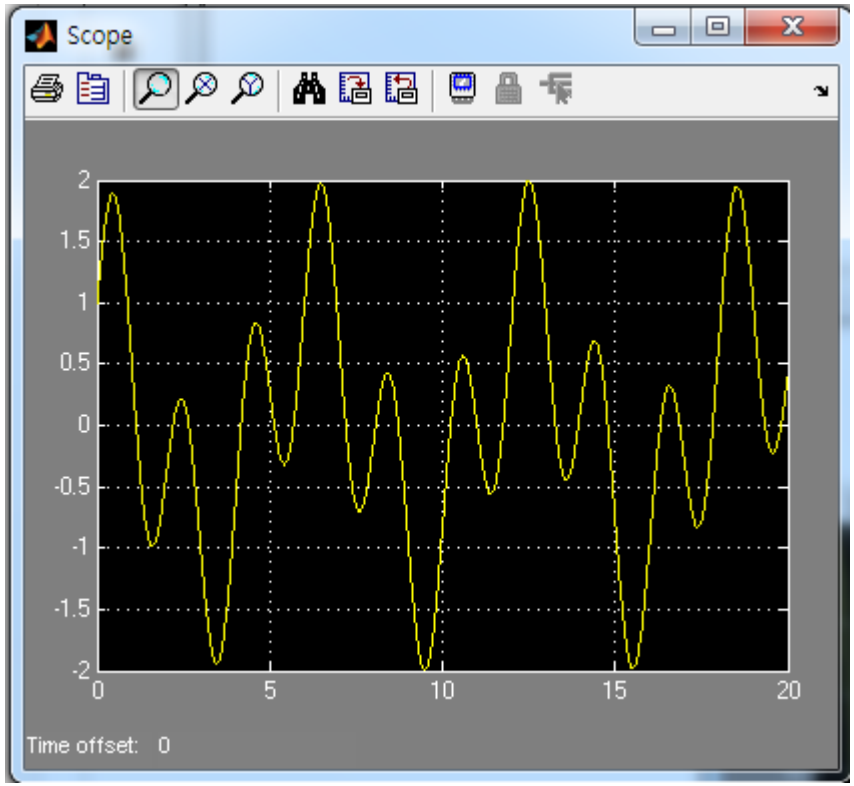

Configuration Parameters: untitled2/Configuration (Active)
Select:
Solver
Data Import/Export
Optimization
Diagnostics
Sample Time
Data Validity
Type Conversion
Connectivity
Compatibility
Model Referencing
Saving
Hardware Implementati...
Model Referencing
Simulation Target
Symbols
Custom Code
Real-Time Workshop
Report
Comments
Symbols
Custom Code
Debug
Interface
HDL Coder
Global Settings
Test Bench
EDA Tool Scripts
Simulation time
Start time: 0.0
Stop time: 20
Solver options
Type: Fixed-step
Solver: ode3 (Bogacki-Shampine)
discrete (no continuous states)
ode8 (Dormand-Prince)
ode4 (Runge-Kutta)
ode2 (Heun)
ode1 (Euler)
ode14x (extrapolation)
Fixed-step size (fundamental sample time): auto
Tasking and sample time options
Periodic sample time constraint:
Tasking mode for periodic sample times: Auto
Automatically handle rate transition for data transfer
Higher priority value indicates higher task priority
OK
Cancel
Help
Apply

시스템 파라메터 설정


Configuration Parameters: untitled2/Configuration (Active)
Select:
Solver
Data Import/Export
Optimization
Diagnostics
Sample Time
Data Validity
Type Conversion
Connectivity
Compatibility
Model Referencing
Saving
Hardware Implementati...
Model Referencing
Simulation Target
Symbols
Custom Code
Real-Time Workshop
Report
Comments
Symbols
Custom Code
Debug
Interface
HDL Coder
Global Settings
Test Bench
EDA Tool Scripts
Simulation time
Start time: 0.0
Stop time: 20
Solver options
Type: Fixed-step
Solver: ode4 (Runge-Kutta)
Fixed-step size (fundamental sample time): 0.01
Tasking and sample time options
Periodic sample time constraint: Unconstrained
Tasking mode for periodic sample times: Auto
Automatically handle rate transition for data transfer
Higher priority value indicates higher task priority
OK
Cancel
Help
Apply

시스템 파라메터 설정


Scope
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
5
10
15
20
Time offset: 0

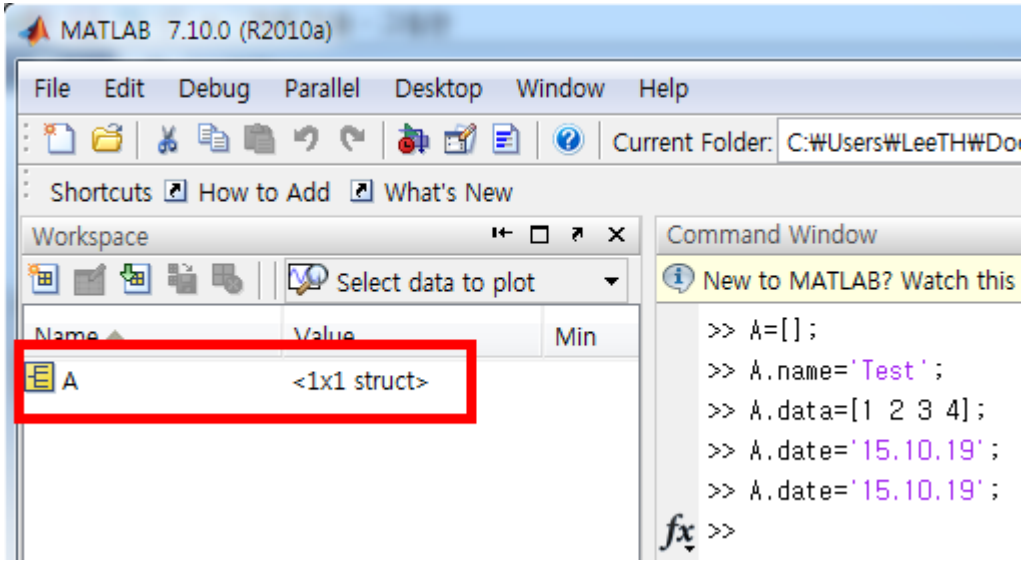

Scope
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
5
10
15
20
Time offset: 0

연습문제

- $\frac{d}{dt}\sin t, \cos t$ 를 한 화면에, $\int \sin t\, dt, -\cos t$ 를 한 화면에 그리고, $\frac{d}{dt}\sin t - \cos t, \int \sin t\, dt + \cos t$ 의 그래프를 각각 그려라.

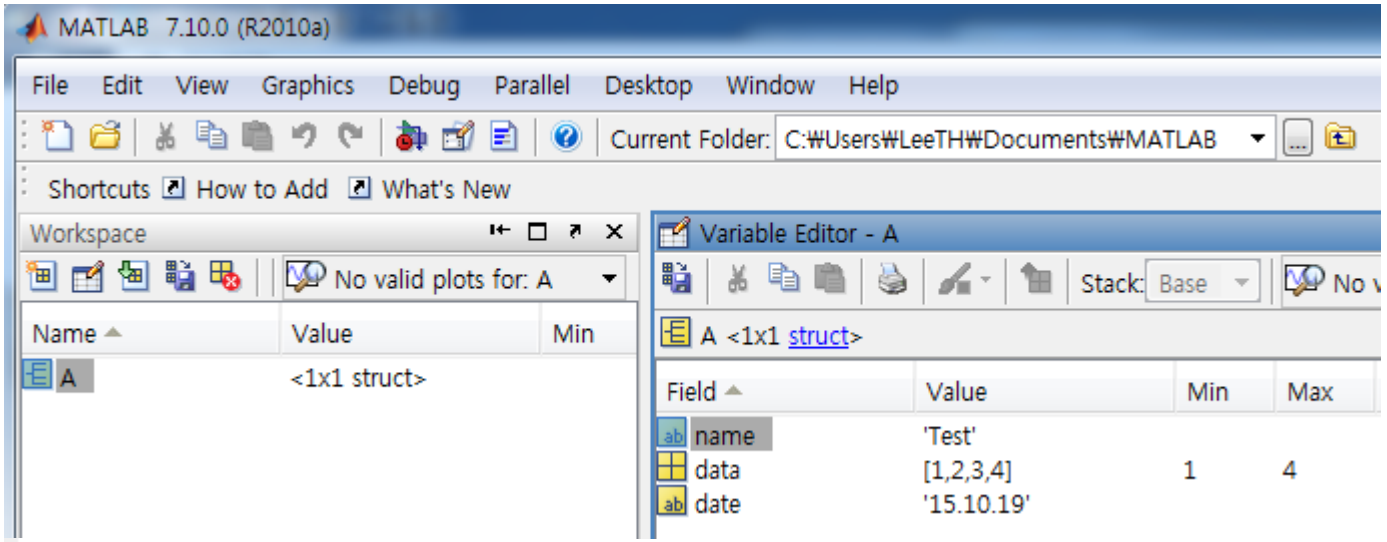
데이터의 구조

- 구조형태의 변수 선언



데이터의 구조

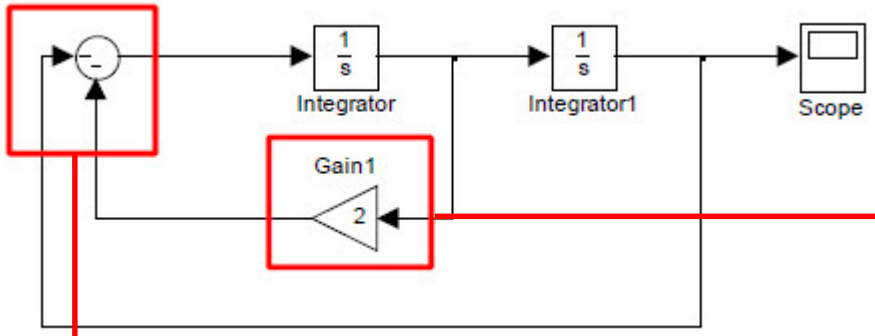
- 구조형태의 변수 값 호출

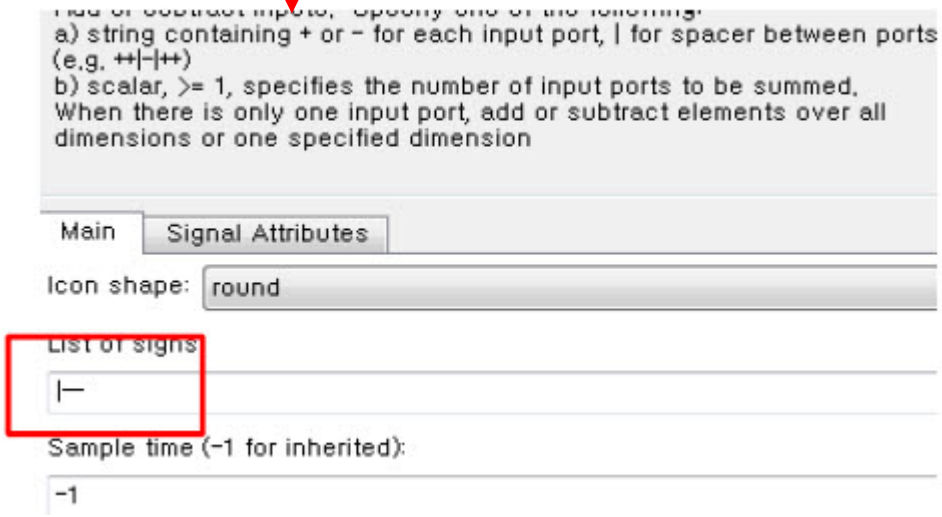


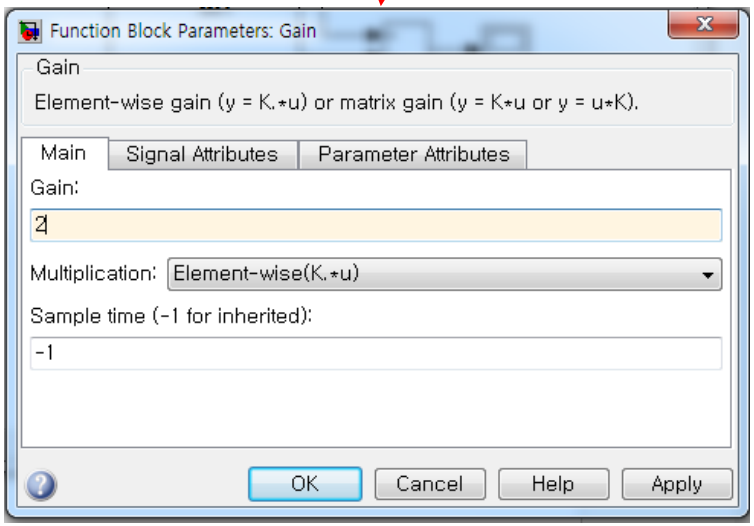

```
>> A

A =

    name: 'Test'
    data: [1 2 3 4]
    date: '15.10.19'

>> A.data

ans =

     1     2     3     4
```

Gain 아이콘

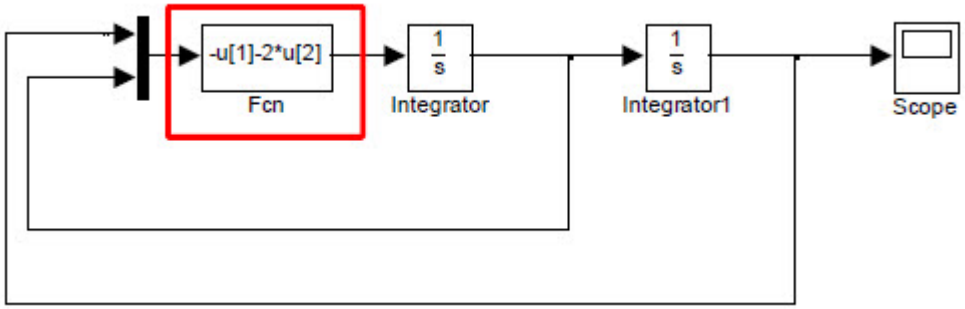
- $\ddot{x} = -2\dot{x} - x$의 식을 가지는 x값을 그려보자.

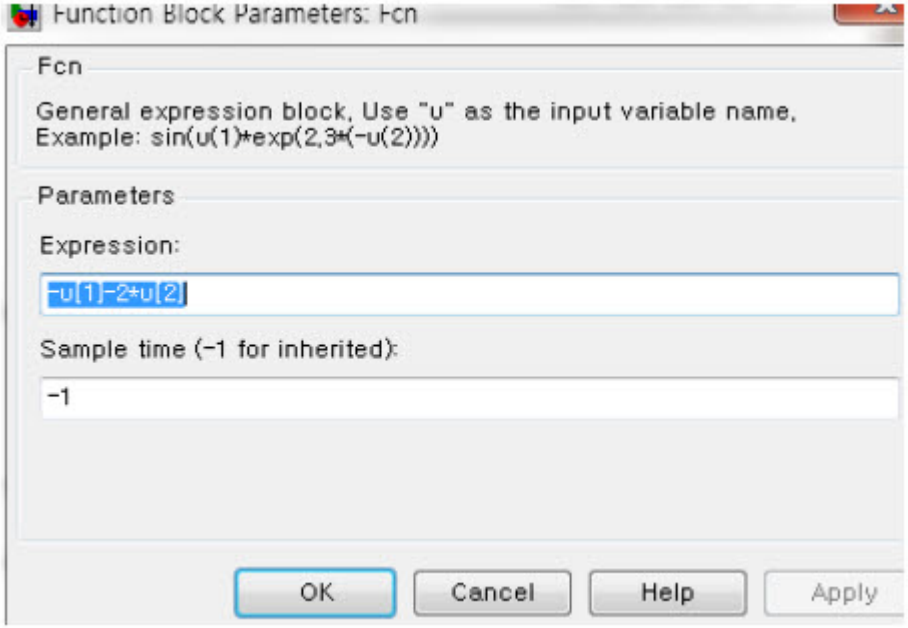




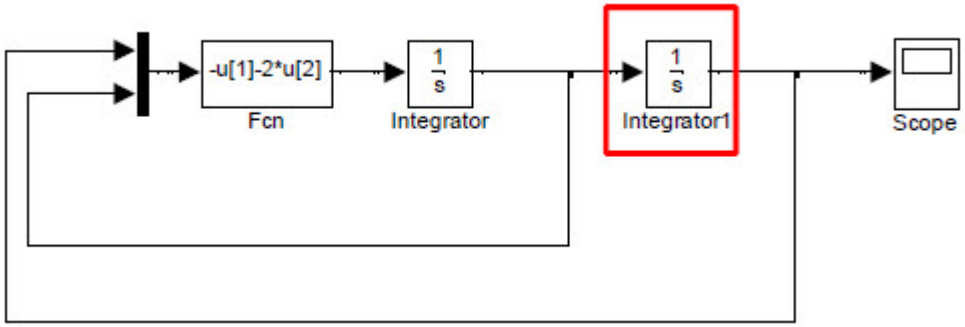


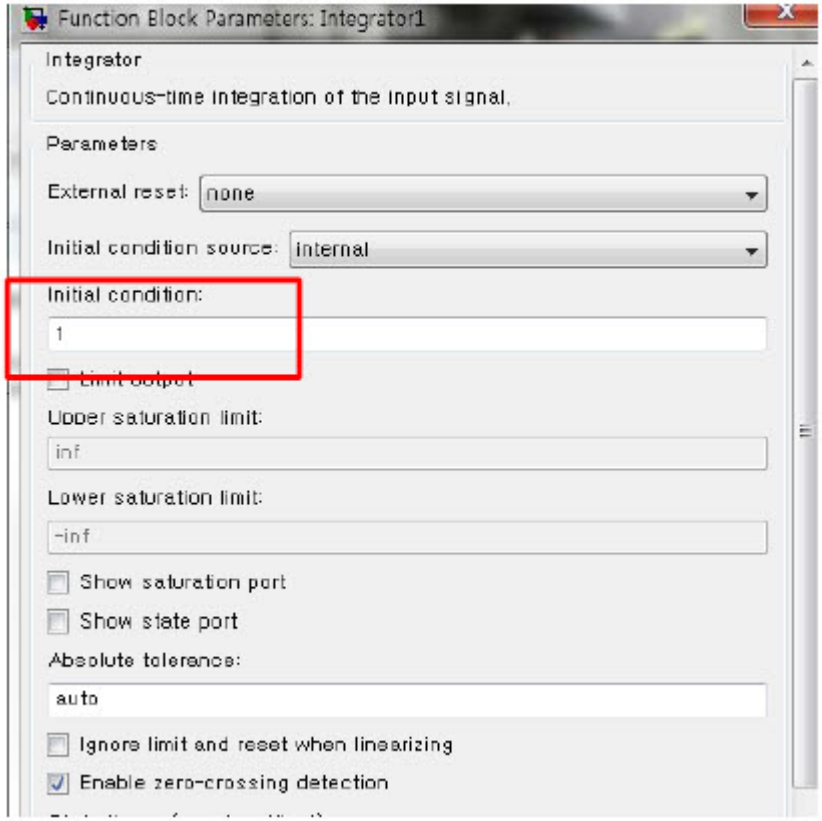
User-defined function 아이콘



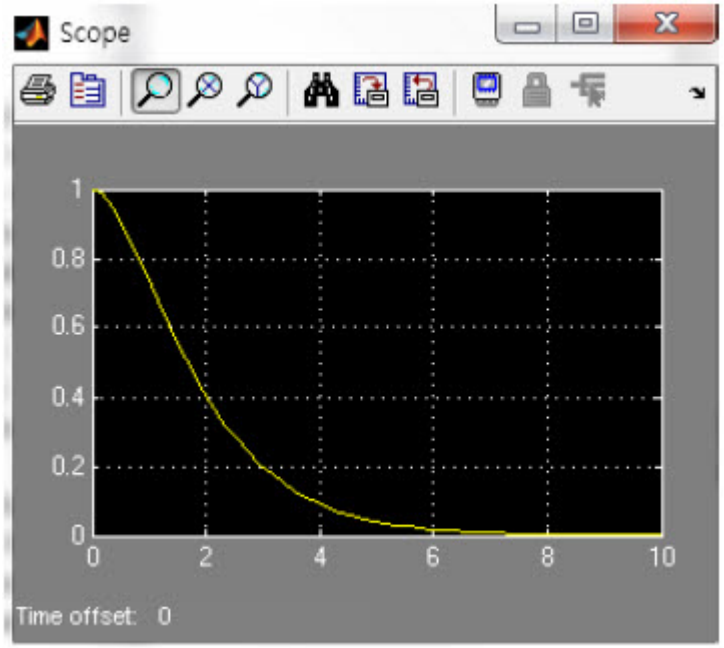


Integrator 아이콘

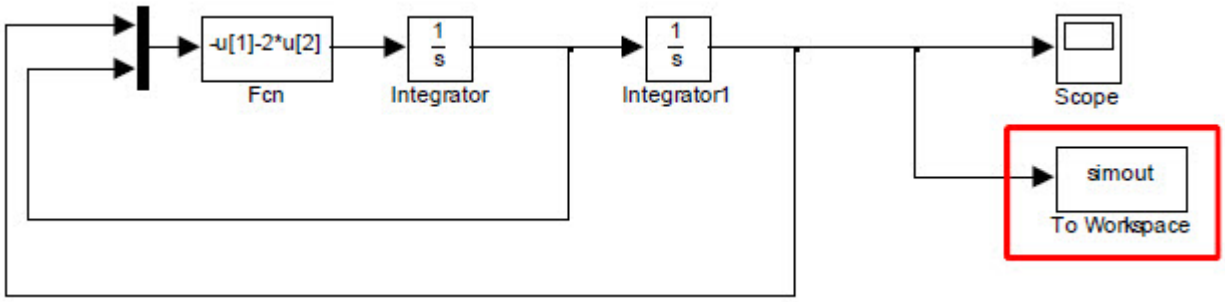




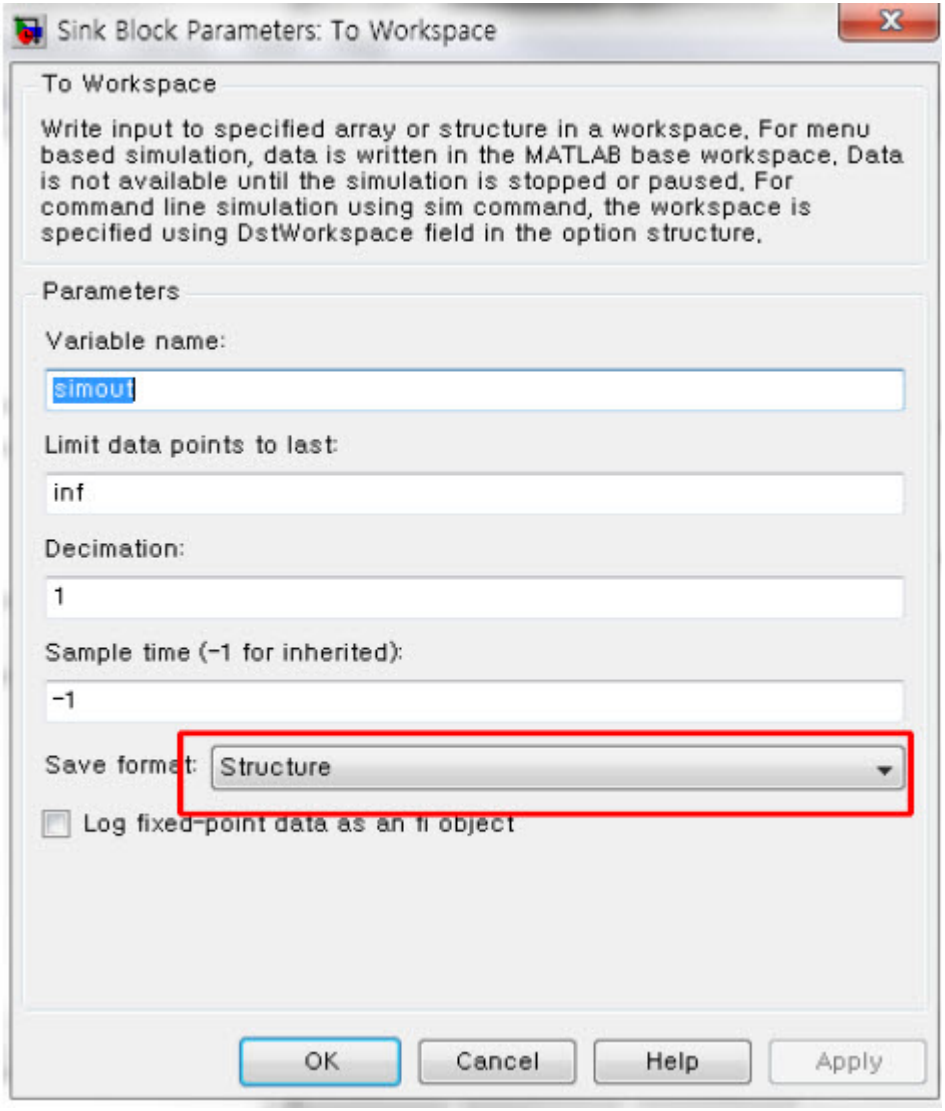
결과



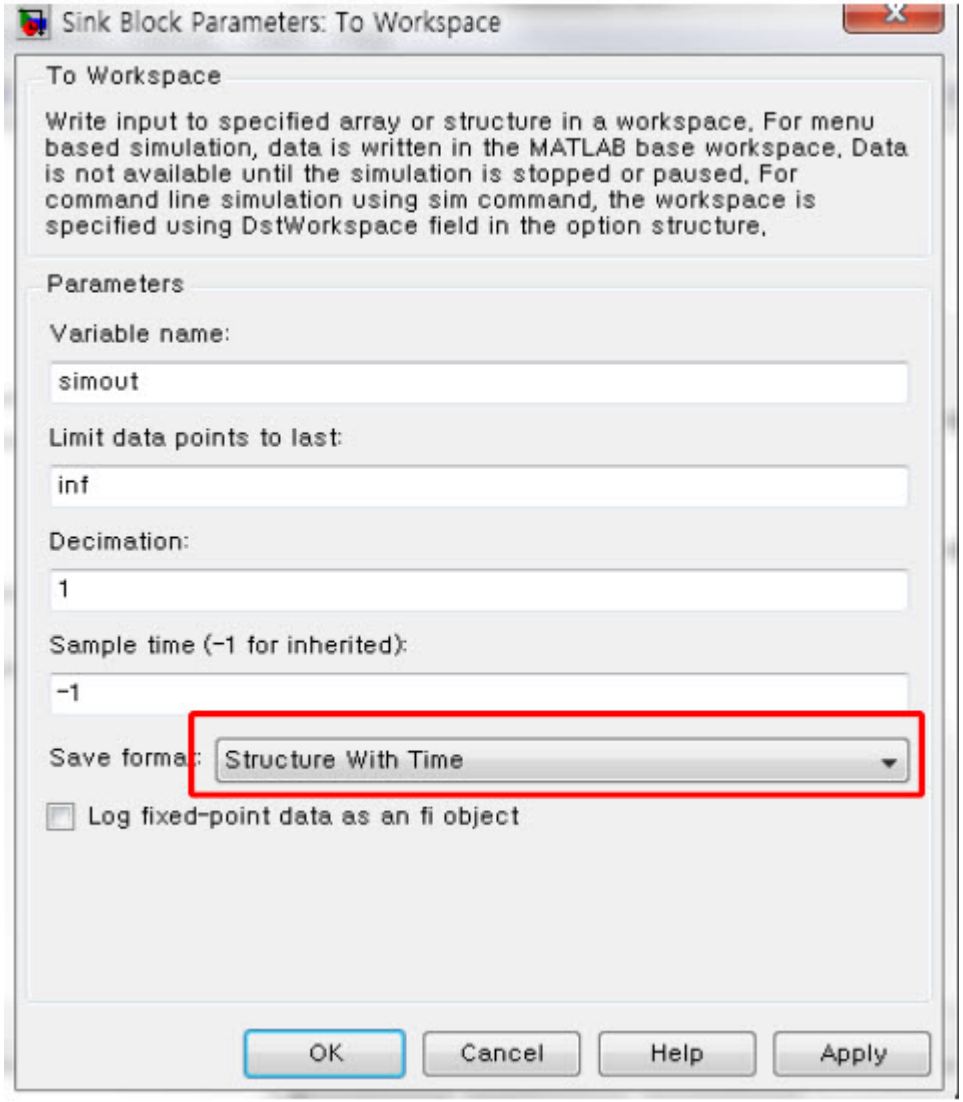
데이터의 저장


-u[1]-2*u[2]
Fcn
1
s
Integrator
1
s
Integrator1
Scope
simout
To Workspace

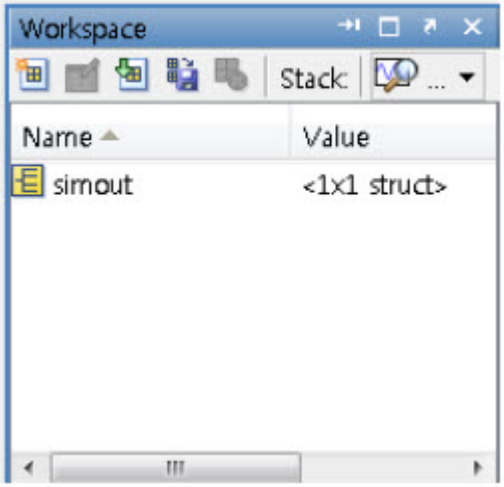
데이터의 저장

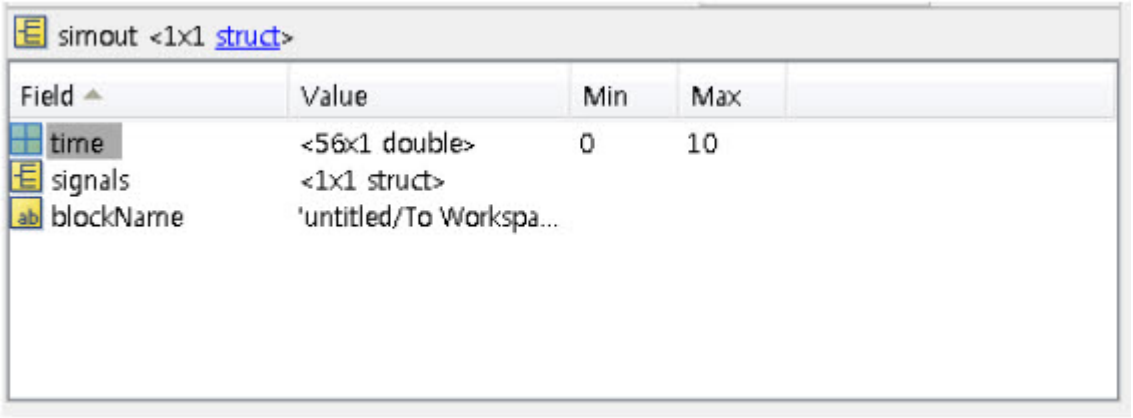

Sink Block Parameters: To Workspace
To Workspace
Write input to specified array or structure in a workspace. For menu based simulation, data is written in the MATLAB base workspace. Data is not available until the simulation is stopped or paused. For command line simulation using sim command, the workspace is specified using DstWorkspace field in the option structure.
Parameters
Variable name:
simout
Limit data points to last:
inf
Decimation:
1
Sample time (-1 for inherited):
-1
Save format:
Structure
Log fixed-point data as an fi object
OK
Cancel
Help
Apply

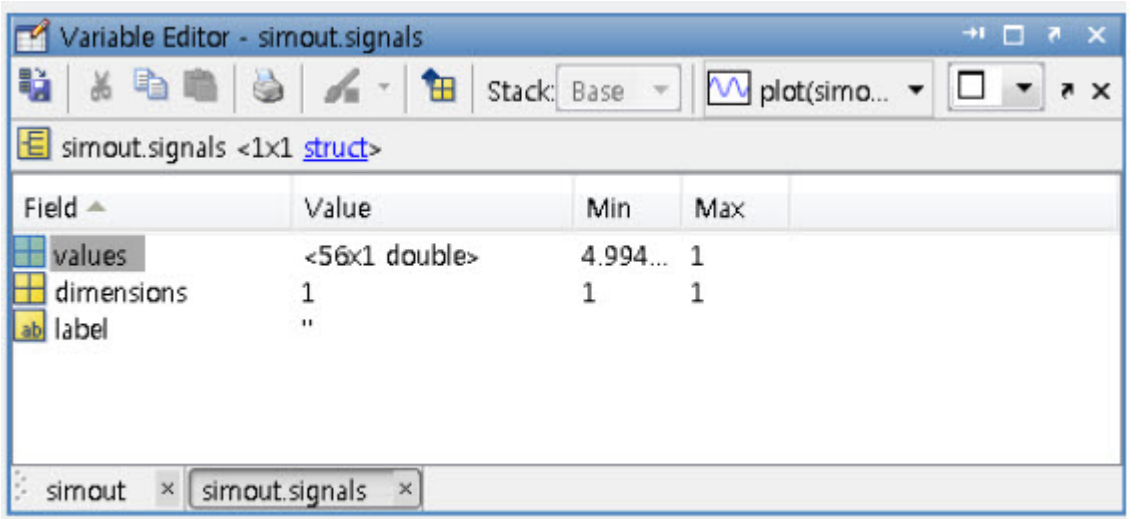
데이터의 저장


Sink Block Parameters: To Workspace
To Workspace
Write input to specified array or structure in a workspace. For menu based simulation, data is written in the MATLAB base workspace. Data is not available until the simulation is stopped or paused. For command line simulation using sim command, the workspace is specified using DstWorkspace field in the option structure.
Parameters
Variable name:
simout
Limit data points to last:
inf
Decimation:
1
Sample time (-1 for inherited):
-1
Save format:
Structure With Time
Log fixed-point data as an fi object
OK
Cancel
Help
Apply

데이터의 저장

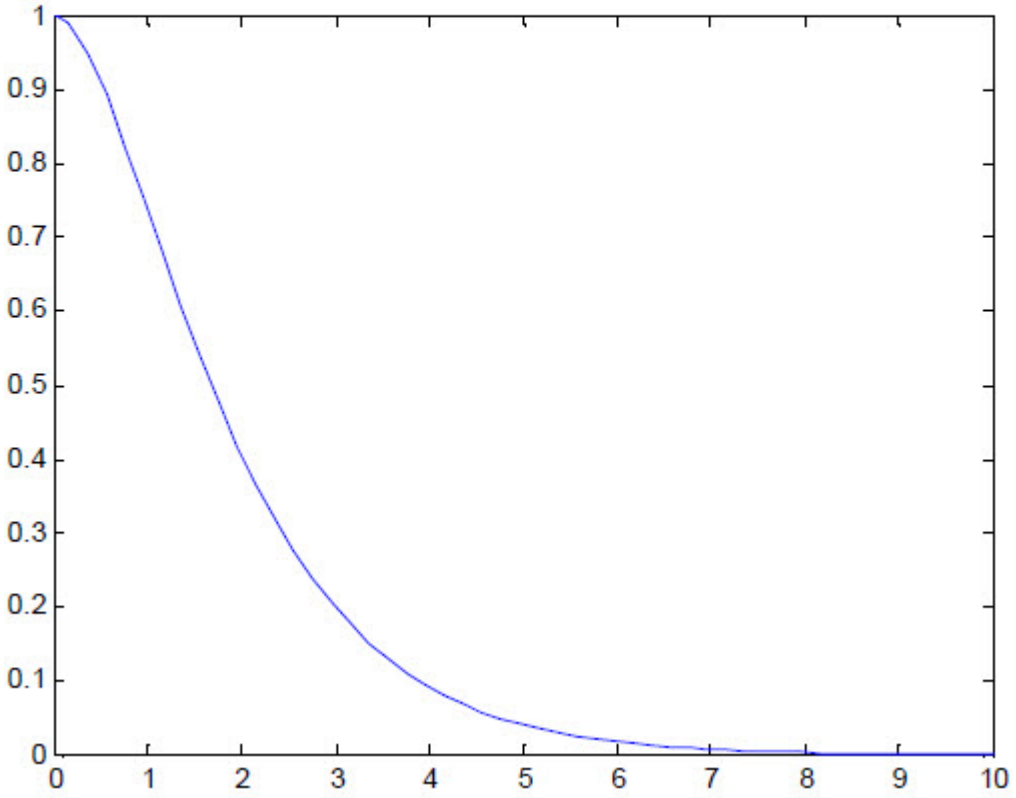

Workspace
Stack:
Name
Value
simout
<1x1 struct>


simout <1x1 struct>
Field
Value
Min
Max
time
<56x1 double>
0
10
signals
<1x1 struct>
blockName
'untitled/To Workspa...

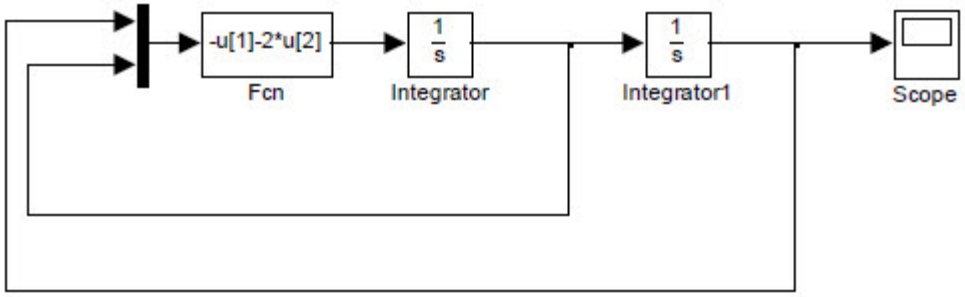

Variable Editor - simout.signals
Stack:
Base
plot(simo...
simout.signals <1x1 struct>
Field
Value
Min
Max
values
<56x1 double>
4.994...
1
dimensions
1
1
1
label
''
simout
simout.signals

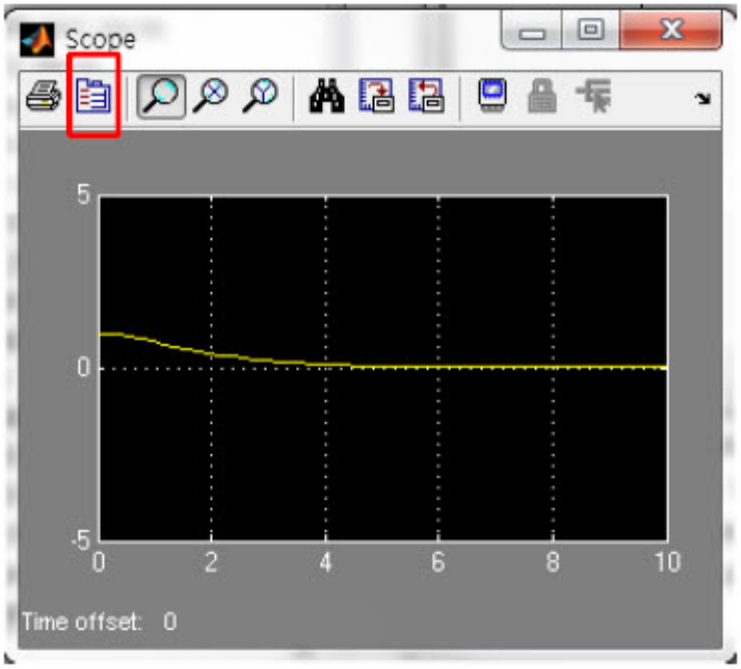
데이터의 저장

```
>> plot(simout.time, simout.signals.values)
```

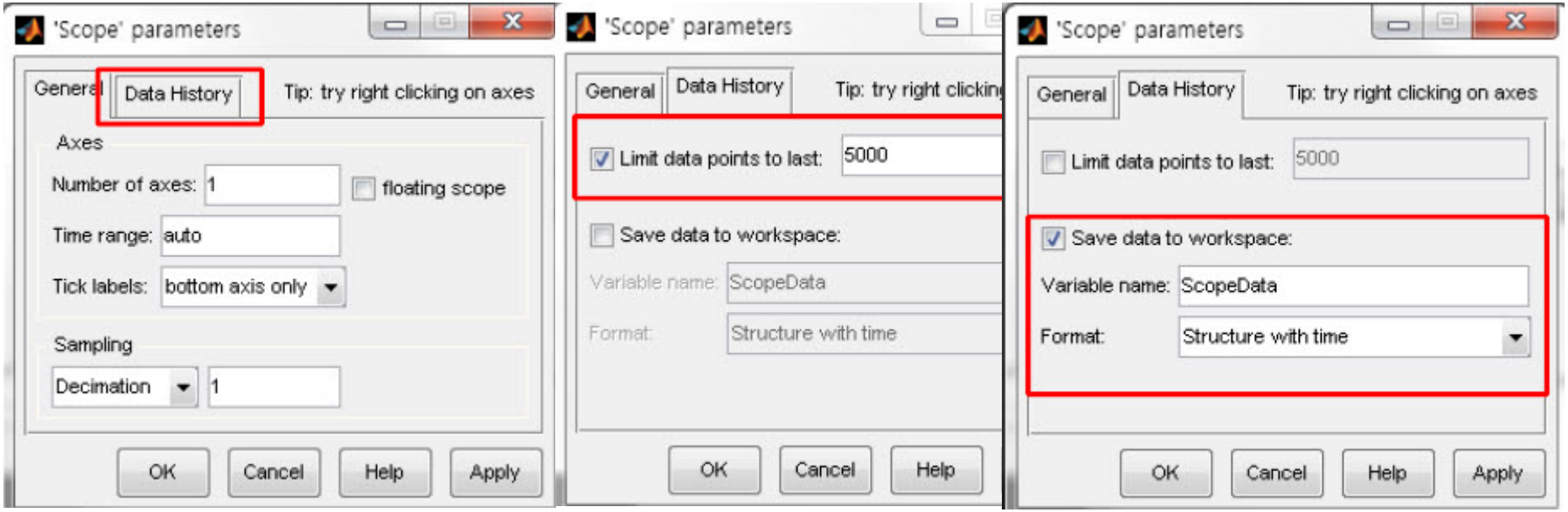


데이터의 저장


-u[1]-2*u[2]
Fcn
1
s
Integrator
1
s
Integrator1
Scope

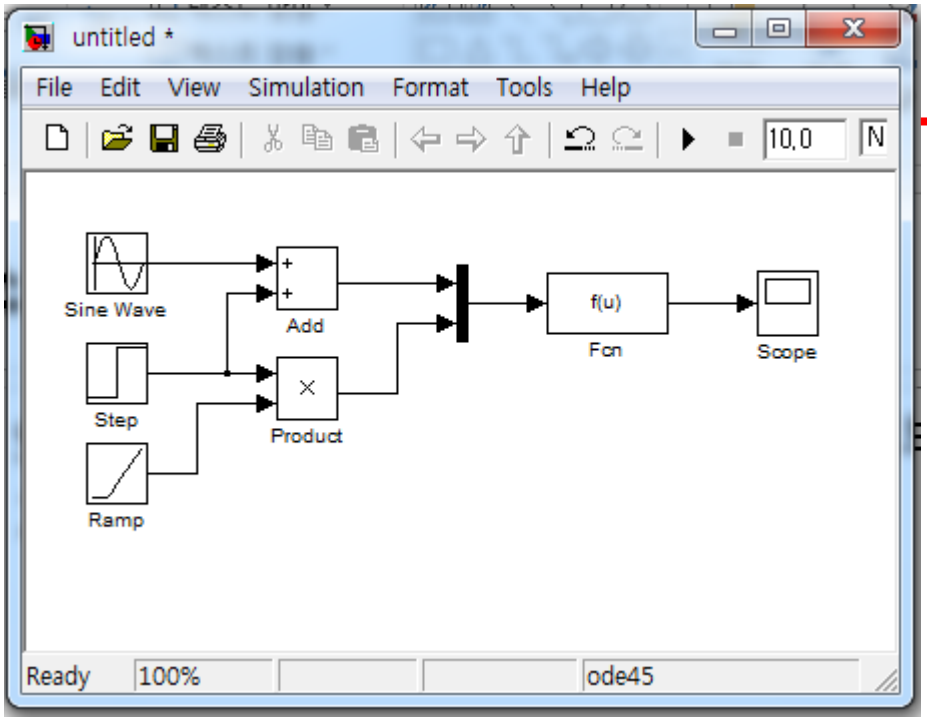

Scope
5
0
-5
0
2
4
6
8
10
Time offset: 0

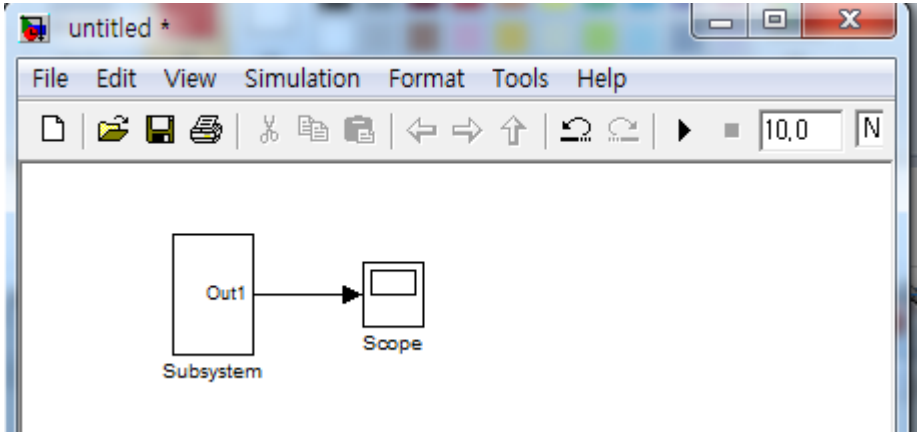
데이터의 저장


'Scope' parameters
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
Decimation 1
OK
Cancel
Help
Apply
'Scope' parameters
General
Data History
Tip: try right clicking
Limit data points to last: 5000
Save data to workspace:
Variable name: ScopeData
Format: Structure with time
OK
Cancel
Help
'Scope' parameters
General
Data History
Tip: try right clicking on axes
Limit data points to last: 5000
Save data to workspace:
Variable name: ScopeData
Format: Structure with time
OK
Cancel
Help
Apply

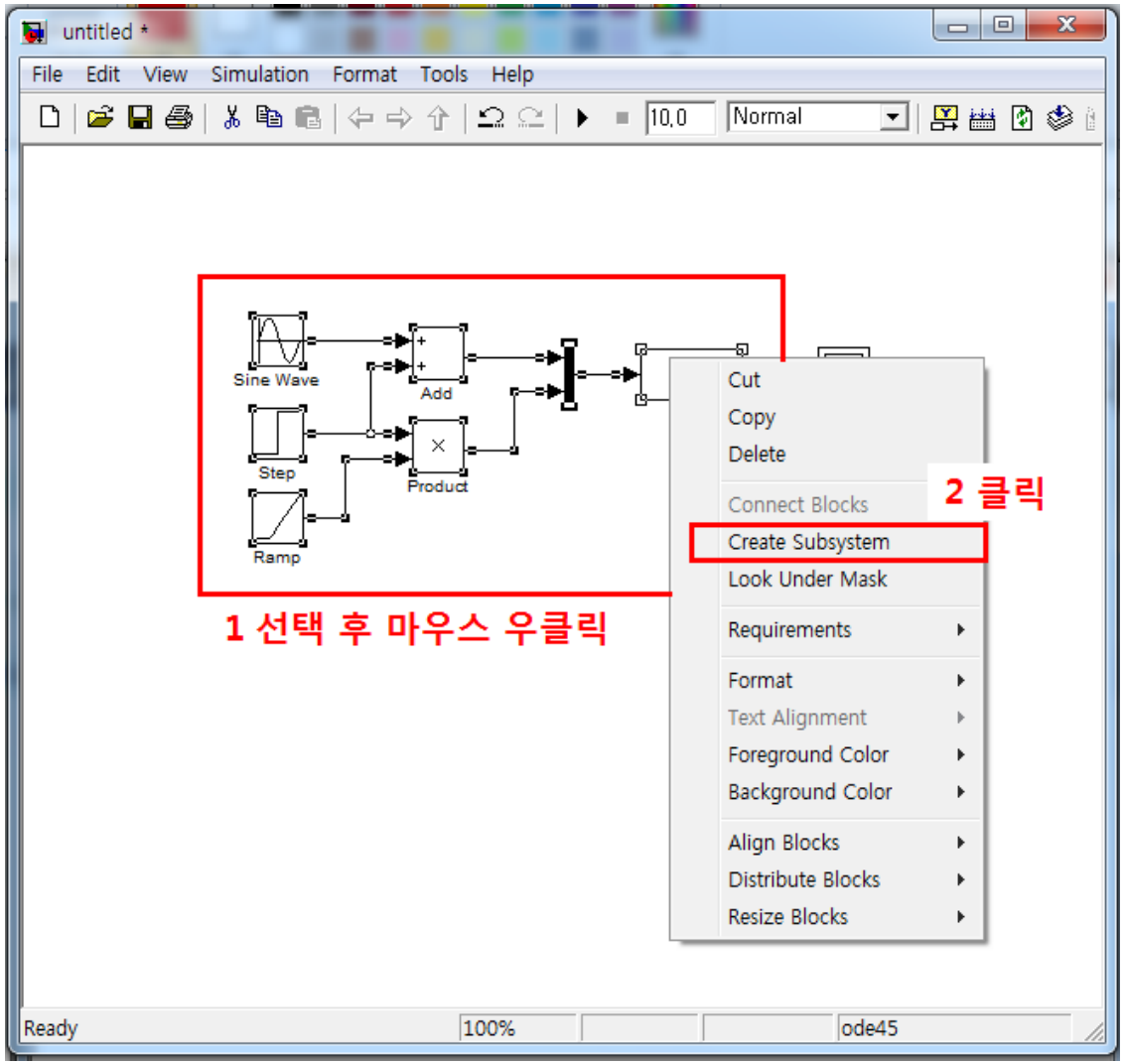
서브시스템 만들기

- 작성된 Simulink 파일이 복잡할 경우 일부분을 하나의 단순 아이콘으로 대체하는 기능



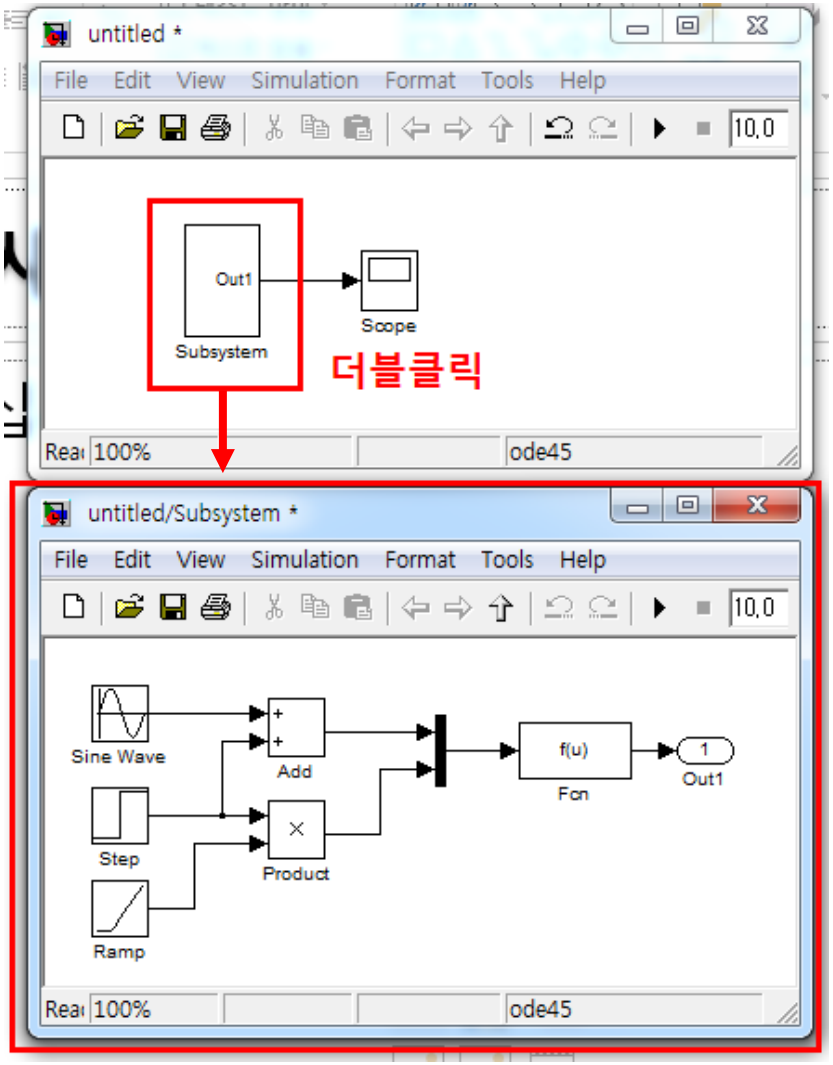


서브시스템 만들기


untitled *
File Edit View Simulation Format Tools Help
10.0
Normal
Sine Wave
Add
Step
Product
Ramp
1 선택 후 마우스 우클릭
Cut
Copy
Delete
Connect Blocks
2 클릭
Create Subsystem
Look Under Mask
Requirements
Format
Text Alignment
Foreground Color
Background Color
Align Blocks
Distribute Blocks
Resize Blocks
Ready
100%
ode45

서브시스템 만들기

- 서브시스템의 확인 및 수정



서브시스템 만들기

- 서브시스템의 입력, 출력 포트의 추가