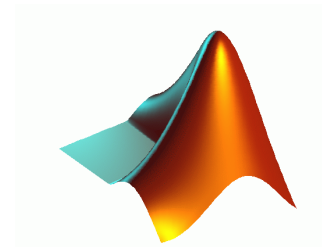




COMS W3101-2

# Programming Languages: MATLAB



Simulink

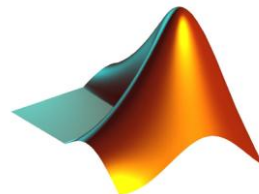
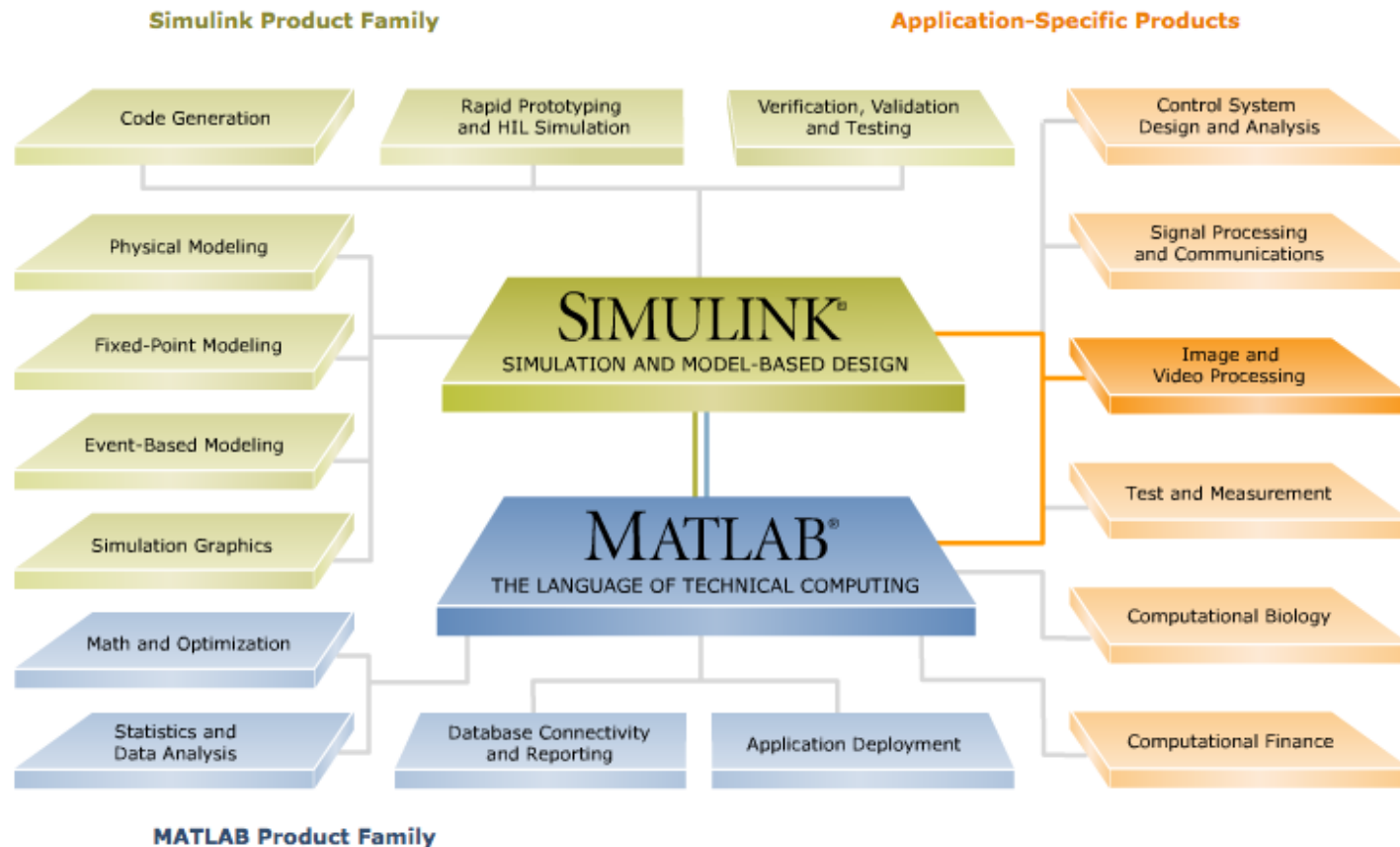
Spring 2010

Daniel Miao

# MathWorks Product Overview

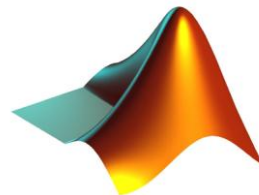
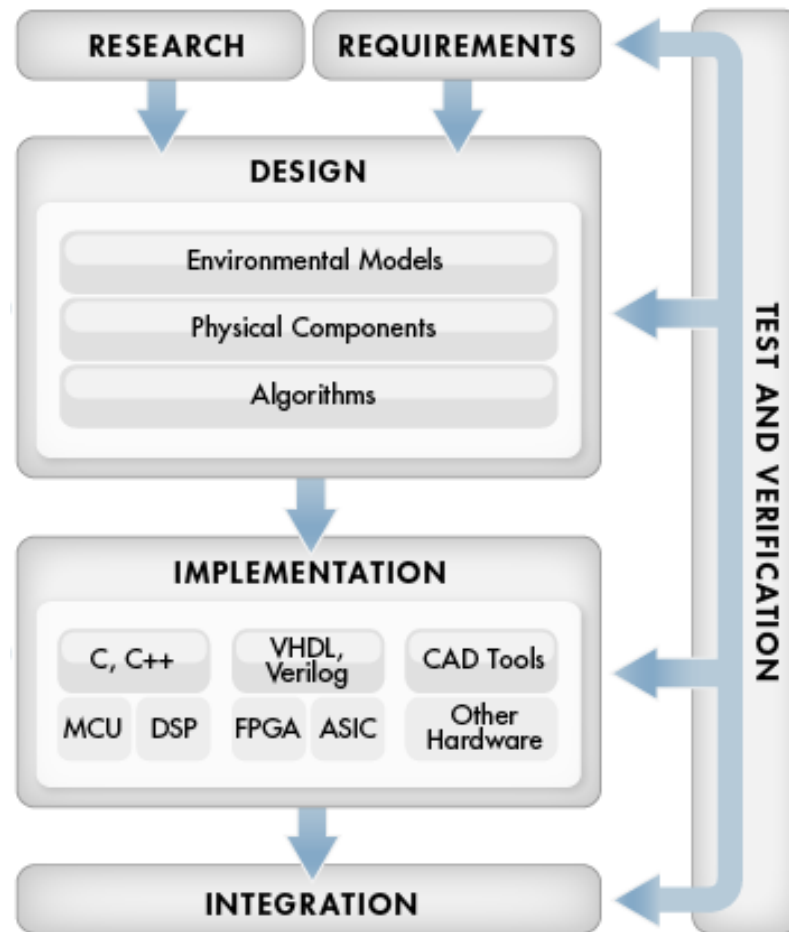
## MathWorks Product Overview

[» View full product list](#)



# Model-Based Design

- ▶ Why Simulink?
- ▶ Answer:
- ▶ Model-Based Design

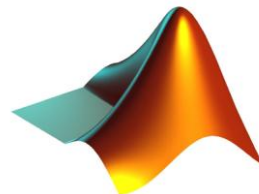
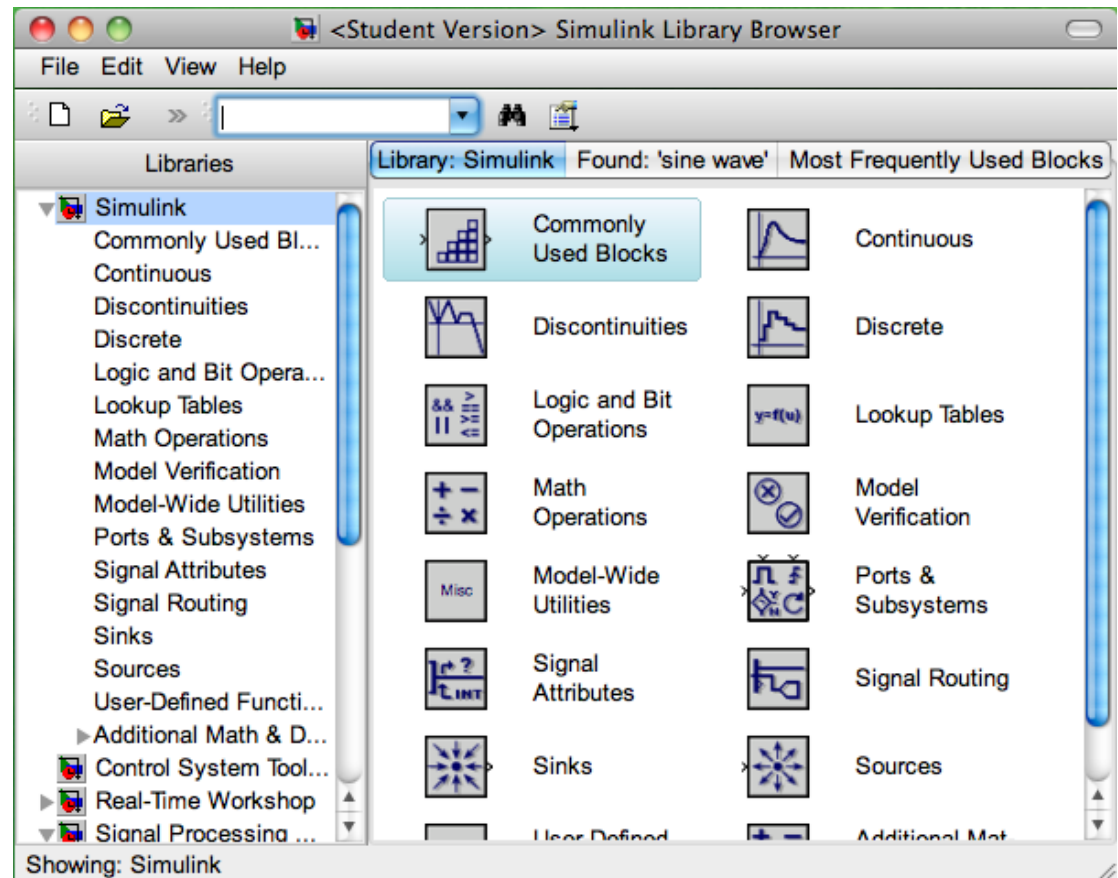
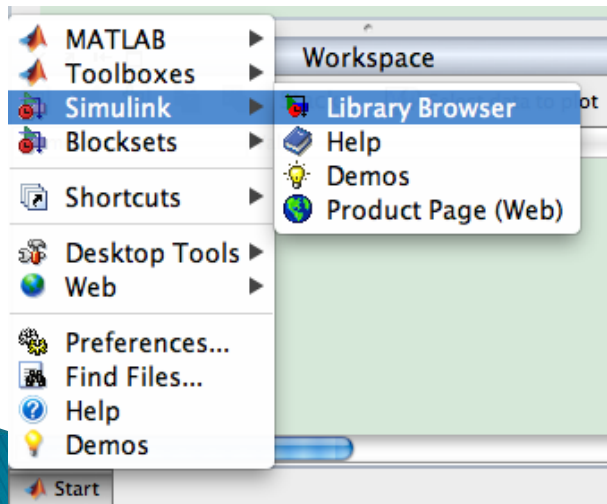


# Simulink Library Browser

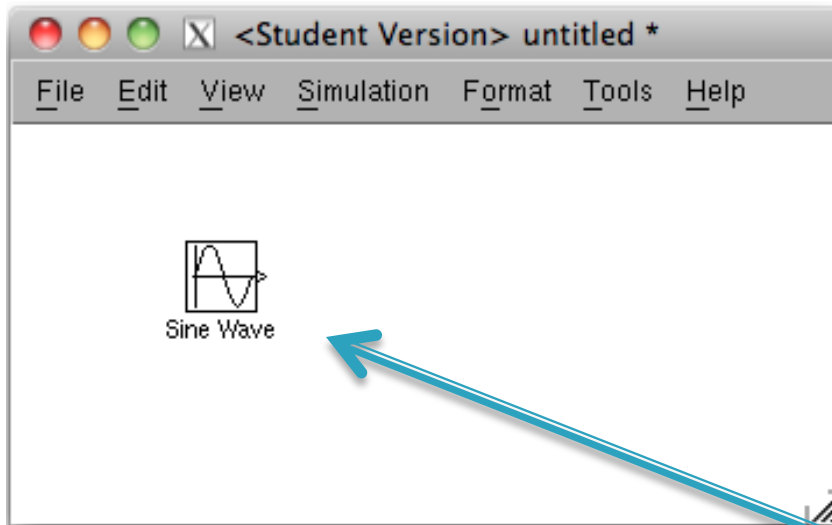
Issue Simulink at the  
MATLAB command  
prompt

>> Simulink

Or



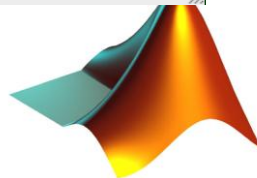
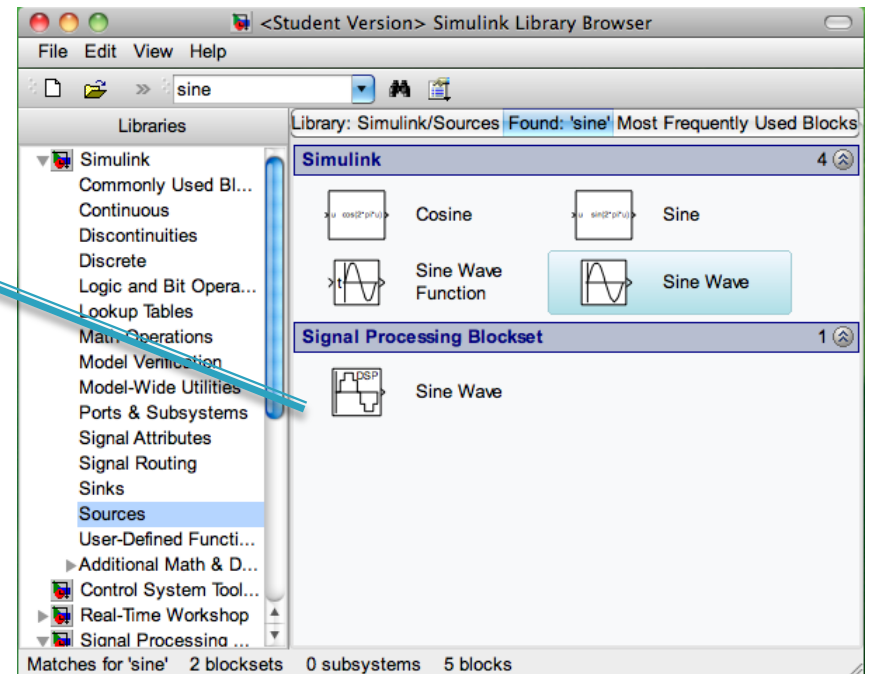
# Simulink Model Construction



drag-n-drop to add  
blocks to a new model

“File -> Save” to save a model

“File -> Open” to load a model

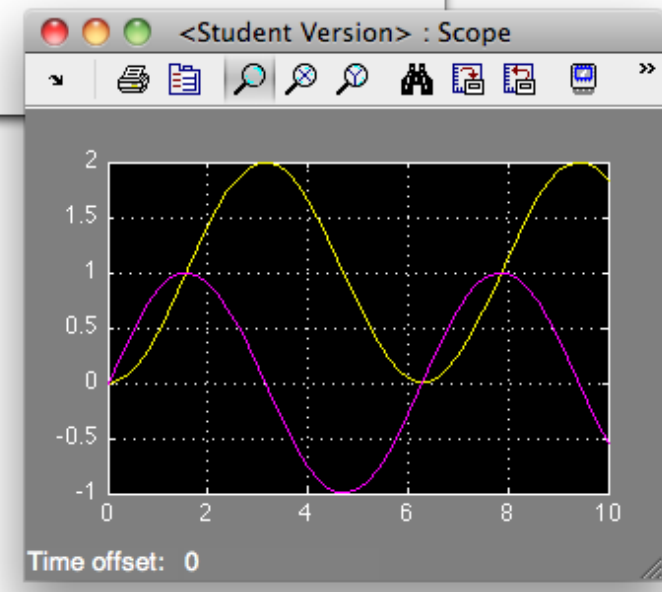
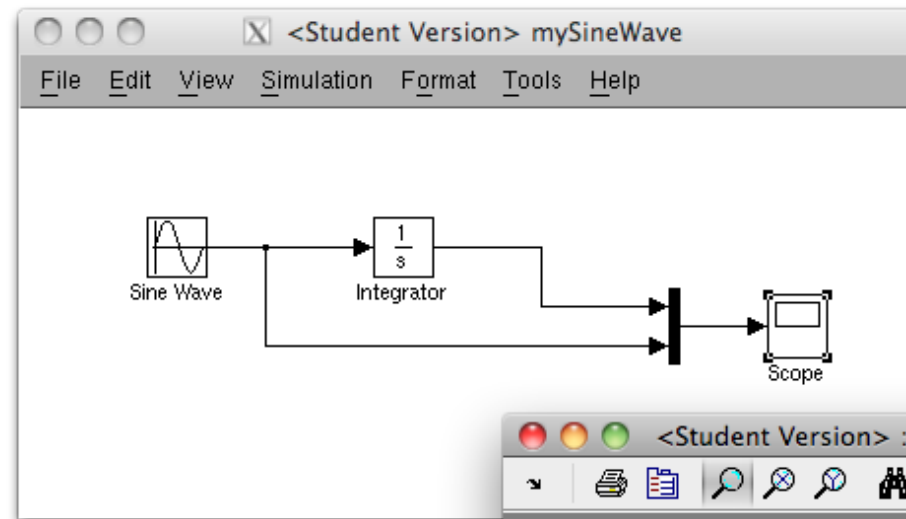


# Model Simulation

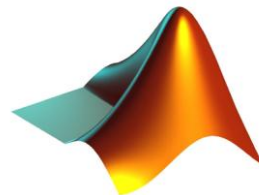
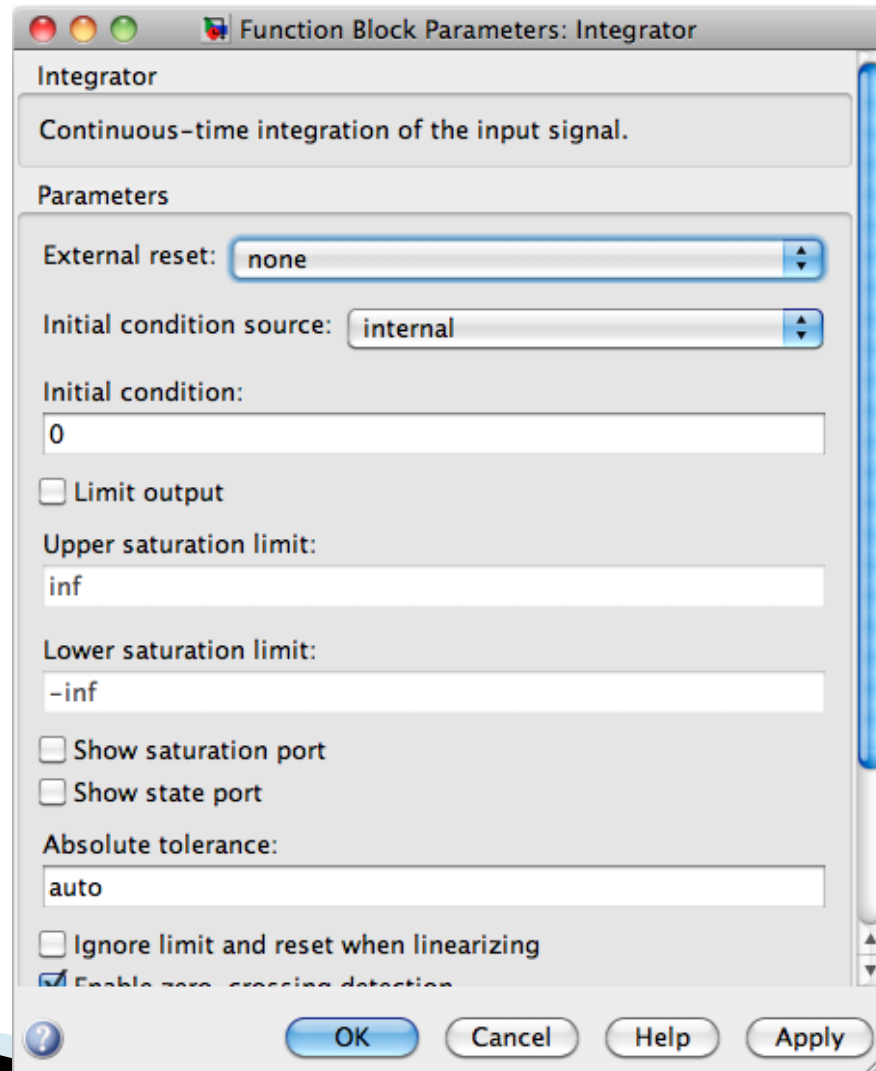
ctrl+t

Or

Simulation ->  
Start



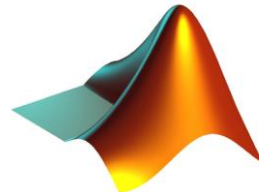
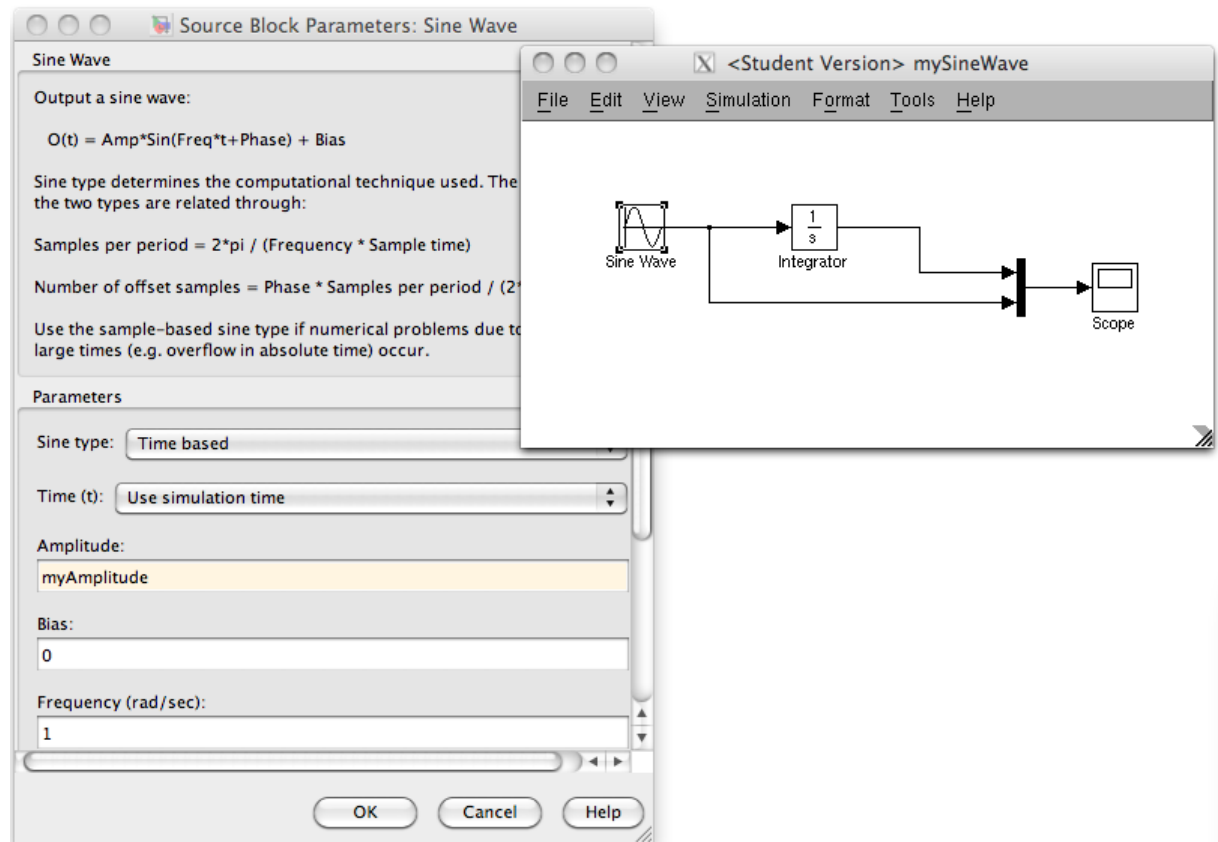
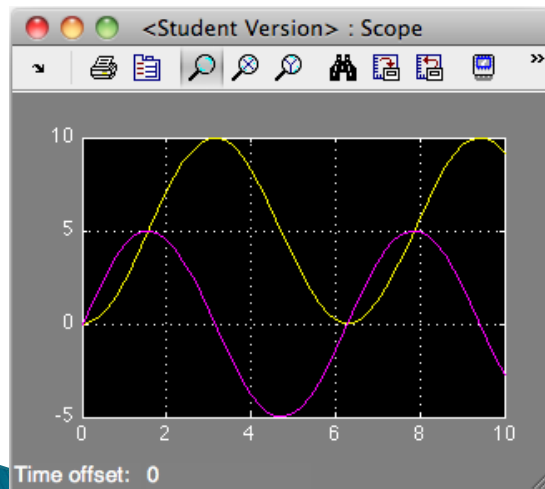
# Simulink Block Parameter





# Using workspace variables

```
>> myAmplitude = 5
```



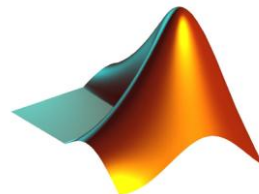
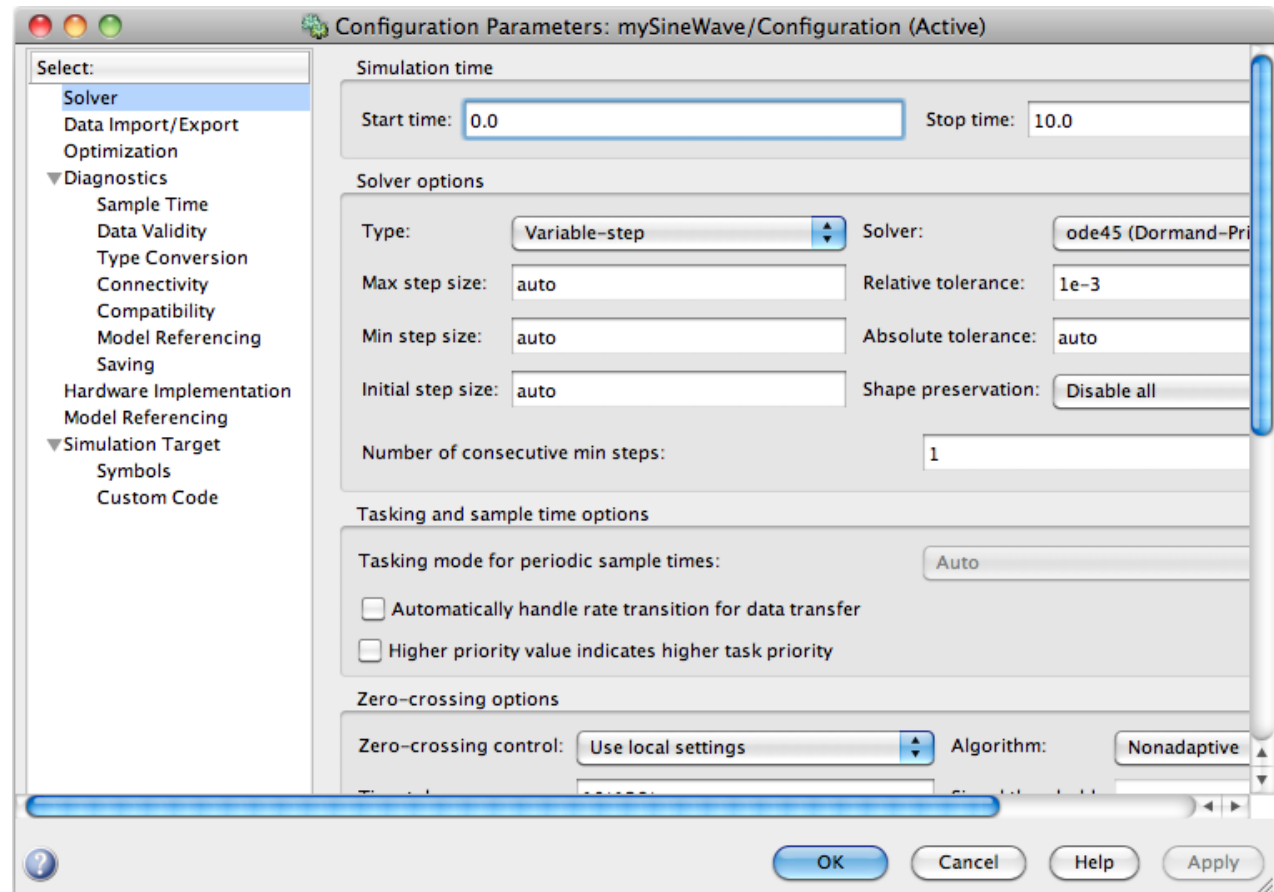


# Configuration Parameters – Solver

Shortcut:  
Ctrl + e

Or

Simulation ->  
Configuration  
Parameters

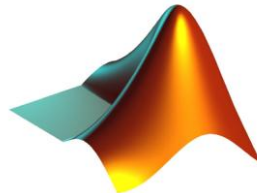


# Configuration Parameter–Data I/O

The image displays two MATLAB/Simulink windows. The main window is the 'Configuration Parameters: mySineWave/Configuration (Active)' dialog, which is used to configure data I/O for a simulation. The left pane shows a tree view of configuration categories, with 'Data Import/Export' selected. The right pane contains several sections:

- Load from workspace:** Includes checkboxes for 'Input' (set to '[t, u]') and 'Initial state' (set to 'xInitial').
- Save to workspace:** Includes checkboxes for 'Time' (set to 'tout'), 'States' (set to 'xout'), and 'Output' (set to 'yout'). It also has checkboxes for 'Final states' (set to 'xFinal'), 'Signal logging' (set to 'logout'), and 'Data stores' (set to 'dsmout'). There are also checkboxes for 'Save complete SimState in final state' and 'Inspect signal logs when simulation is paused/stopped'.
- Save options:** Includes a checkbox for 'Limit data points to last' (set to 1000), a 'Decimation' field (set to 1), a 'Format' dropdown (set to 'Structure'), an 'Output options' dropdown (set to 'Refine output'), a 'Refine factor' field (set to 1), and a checkbox for 'Return as single object' (set to 'out').

At the bottom of the dialog are 'OK', 'Cancel', 'Help', and 'Apply' buttons. In the bottom-left corner, a smaller window titled '<Student Version> mySineWaveInOut' shows a Simulink model. The model consists of a 'Sine Wave' block connected to an 'Integrator' block (labeled  $\frac{1}{s}$ ). The output of the integrator is connected to two output ports labeled 'Out1' and 'Out2'. The outputs are also connected to a 'Scope' block.

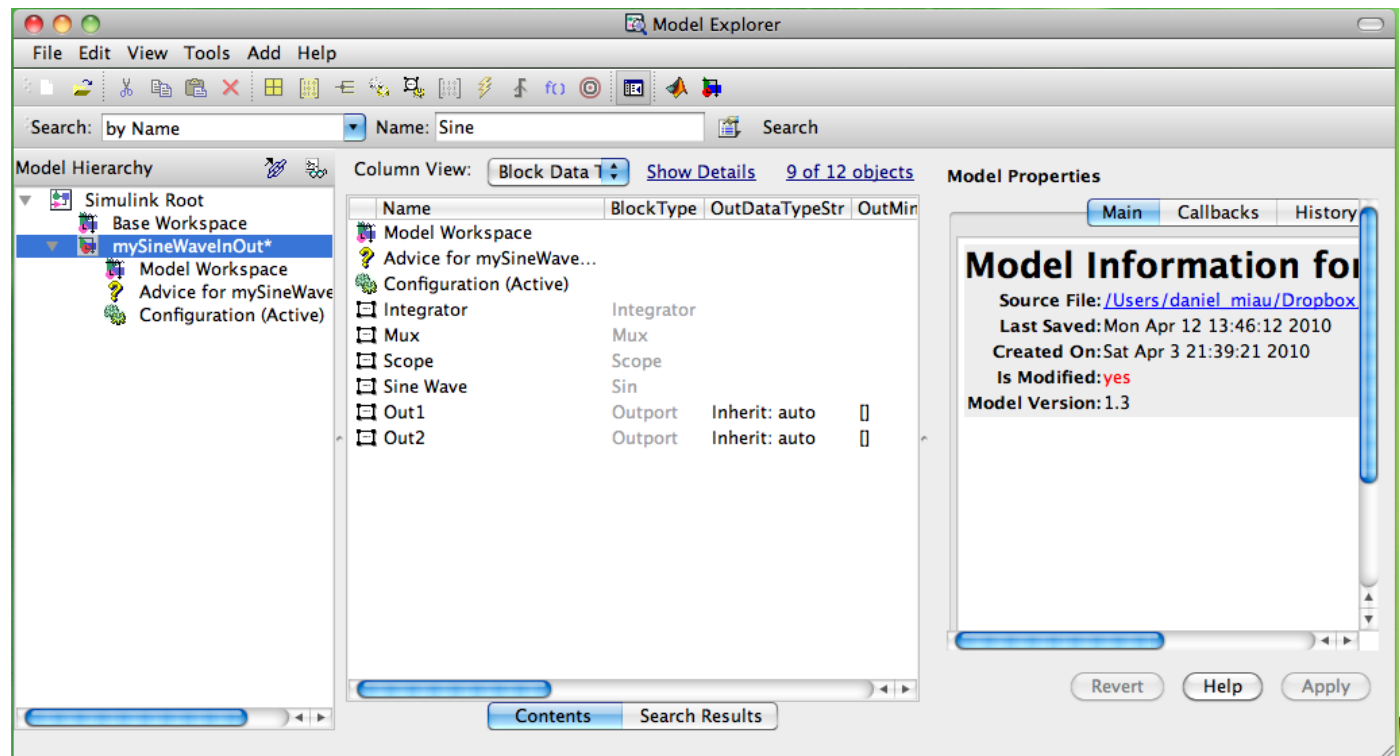


# Simulink Model Explorer

To launch Model Explorer:

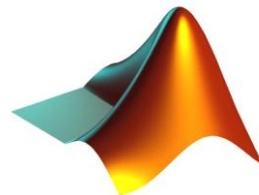
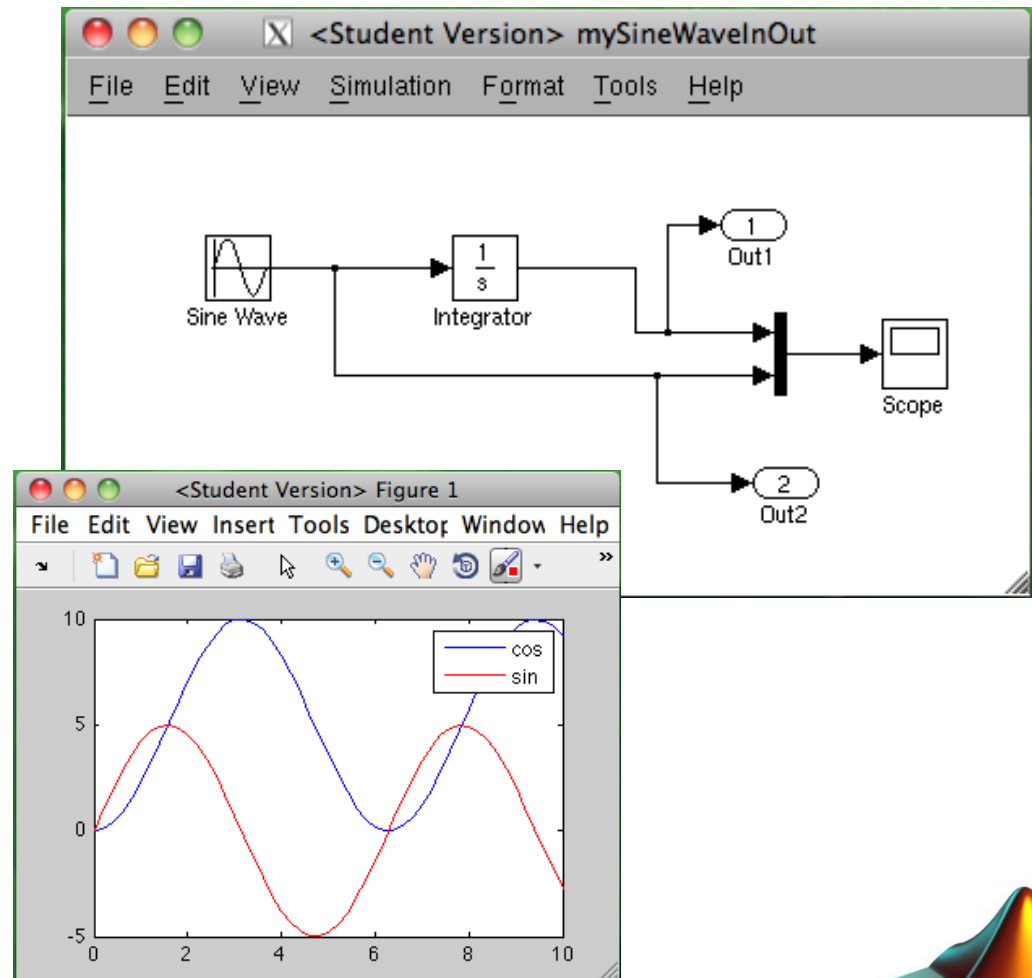
-View - Model Explorer

-Ctrl + H



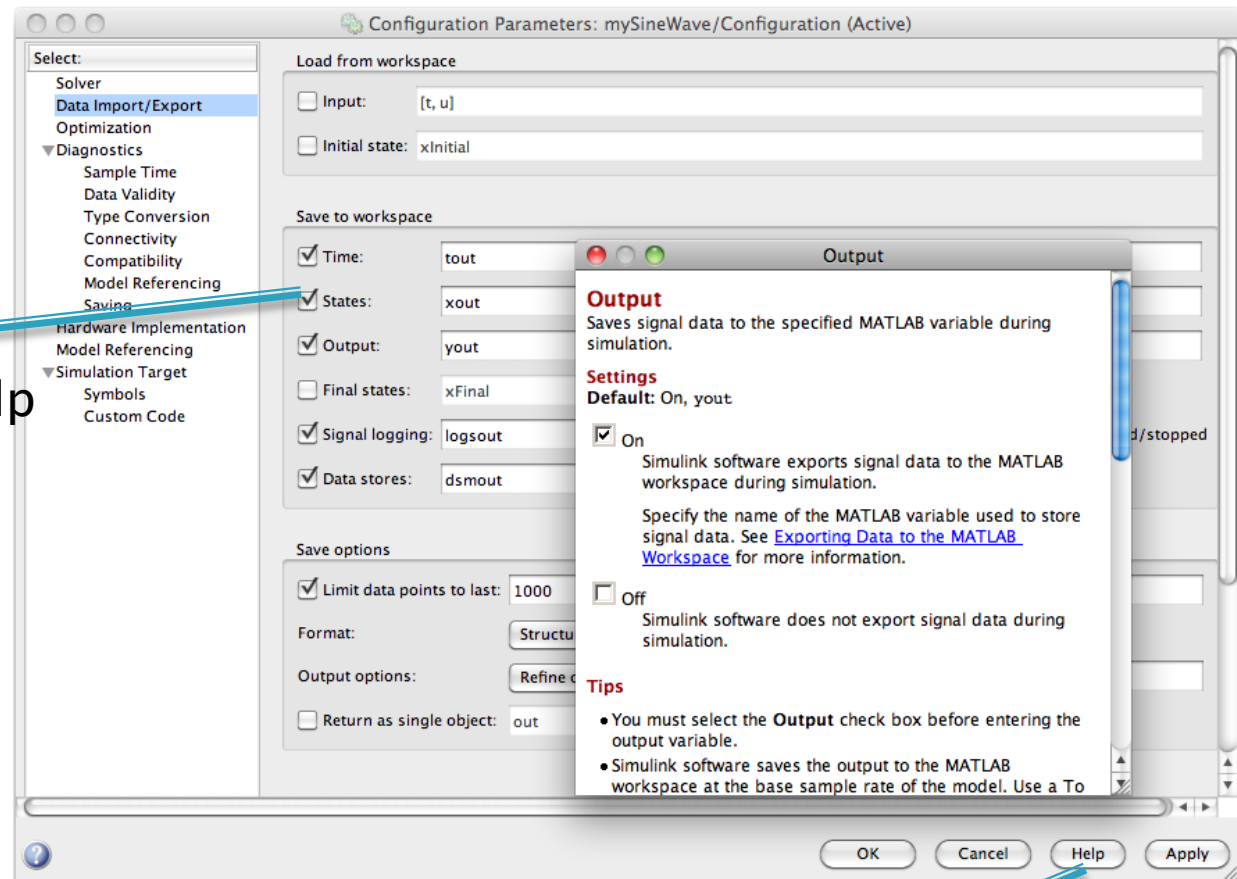
# Running Simulation Programmatically

- ▶ `mdl =`  
`'mySineWaveInOut'`
- ▶ `load_system(mdl)`
- ▶ `myAmp = 5`
- ▶ `sim(mdl)`
- ▶ `plot(tout, yout(:, 1), 'b')`
- ▶ `Hold on`
- ▶ `Plot(tout, yout(:, 2), 'r')`
- ▶ `Legend('cos', 'sin')`

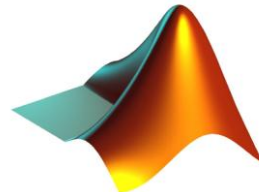


# Simulink Help

Right-click to  
get context-sensitive help



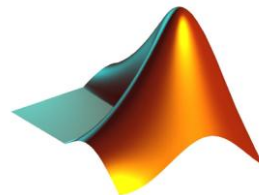
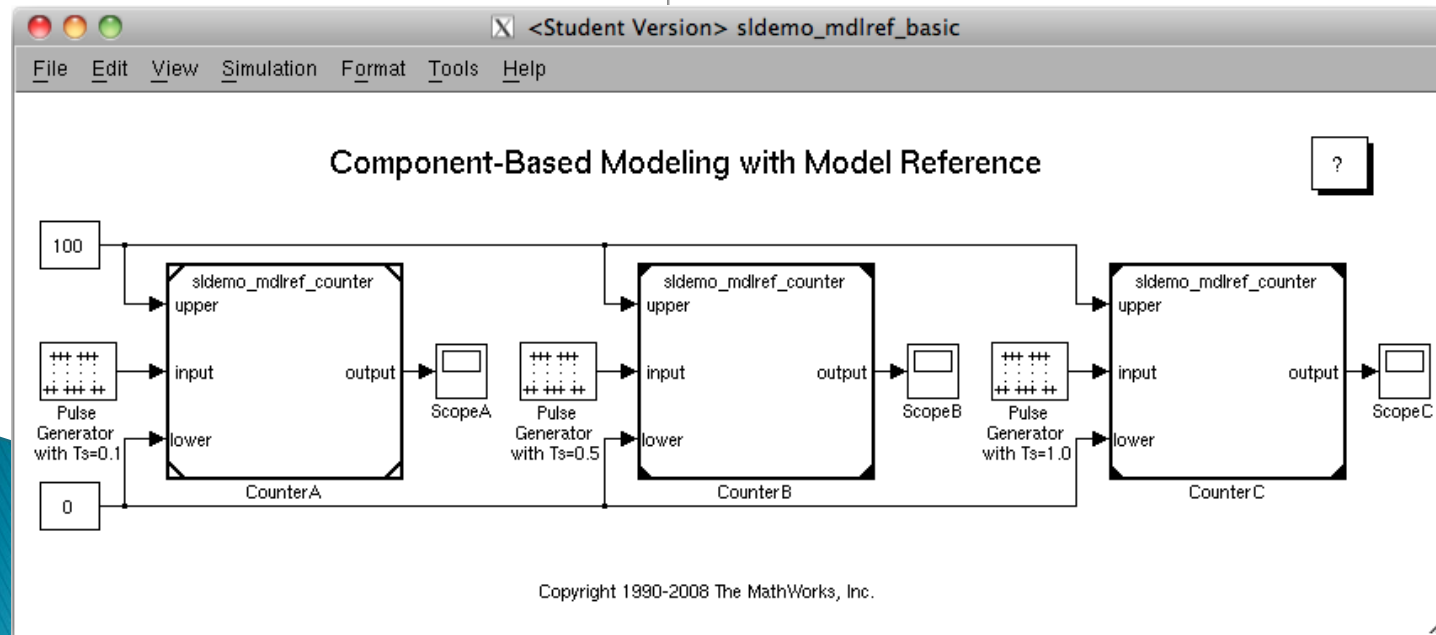
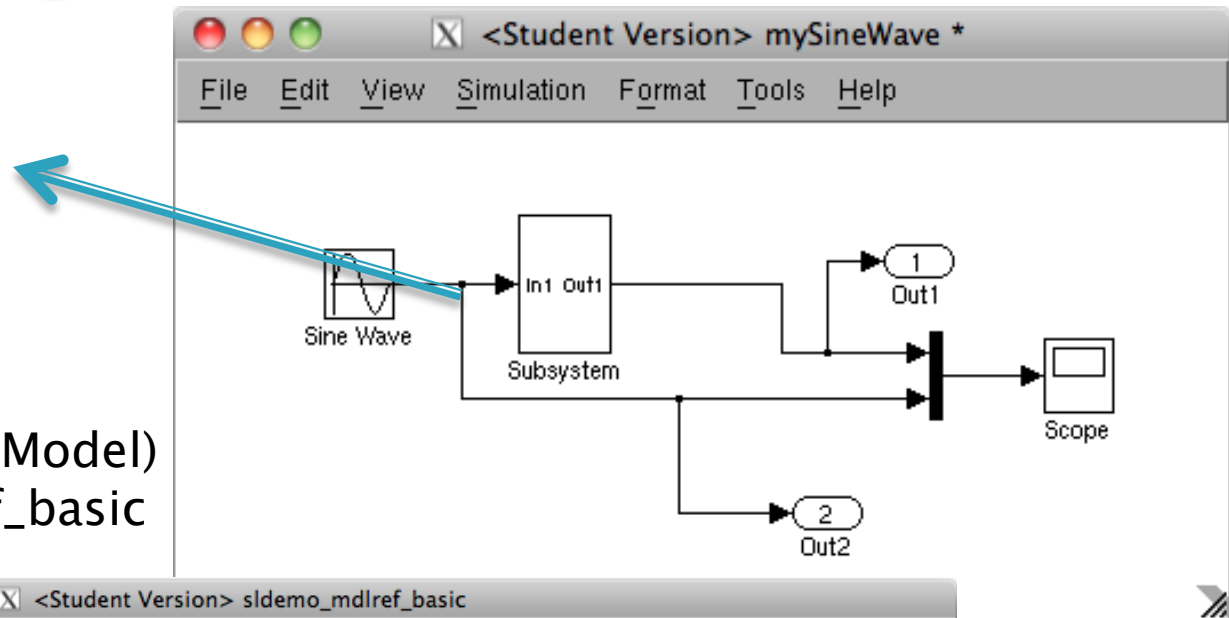
Click help to access  
MATLAB/Simulink  
help



# Model Organization

Subsystem:  
Ctrl + g to convert  
selected area  
to a subsystem

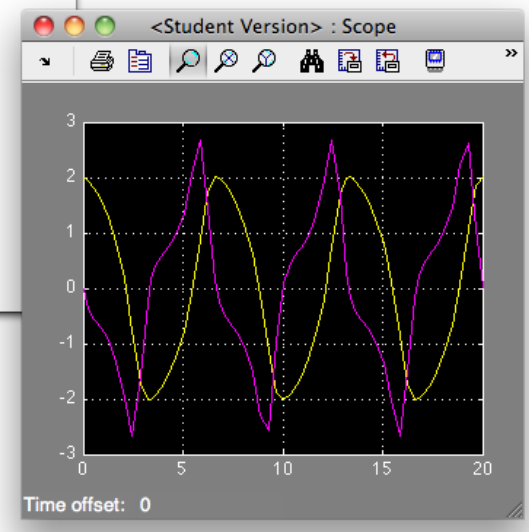
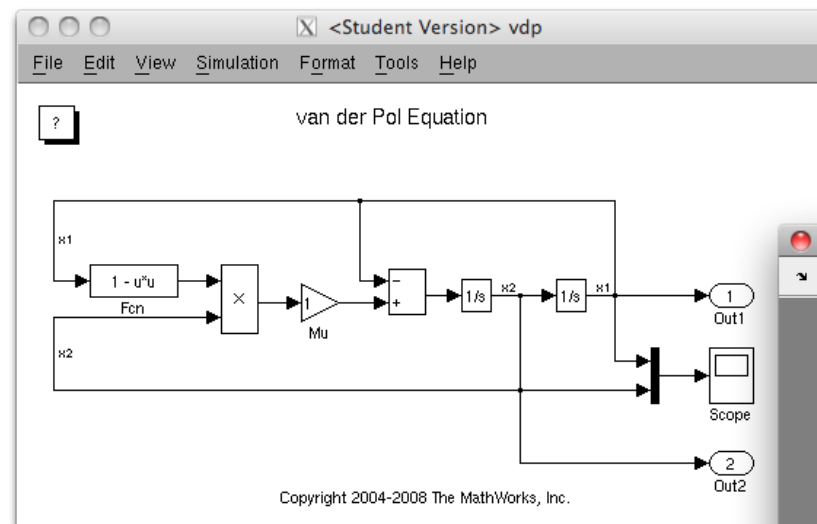
Model Reference:  
(Port&Subsystems -> Model)  
Demo: sldemo\_mdref\_basic



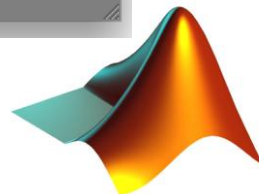
# Example: van der Pol Equation

$$y'' - \mu(1 - y^2)y' + y = 0$$

>> vdp

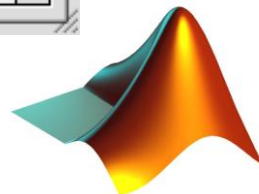
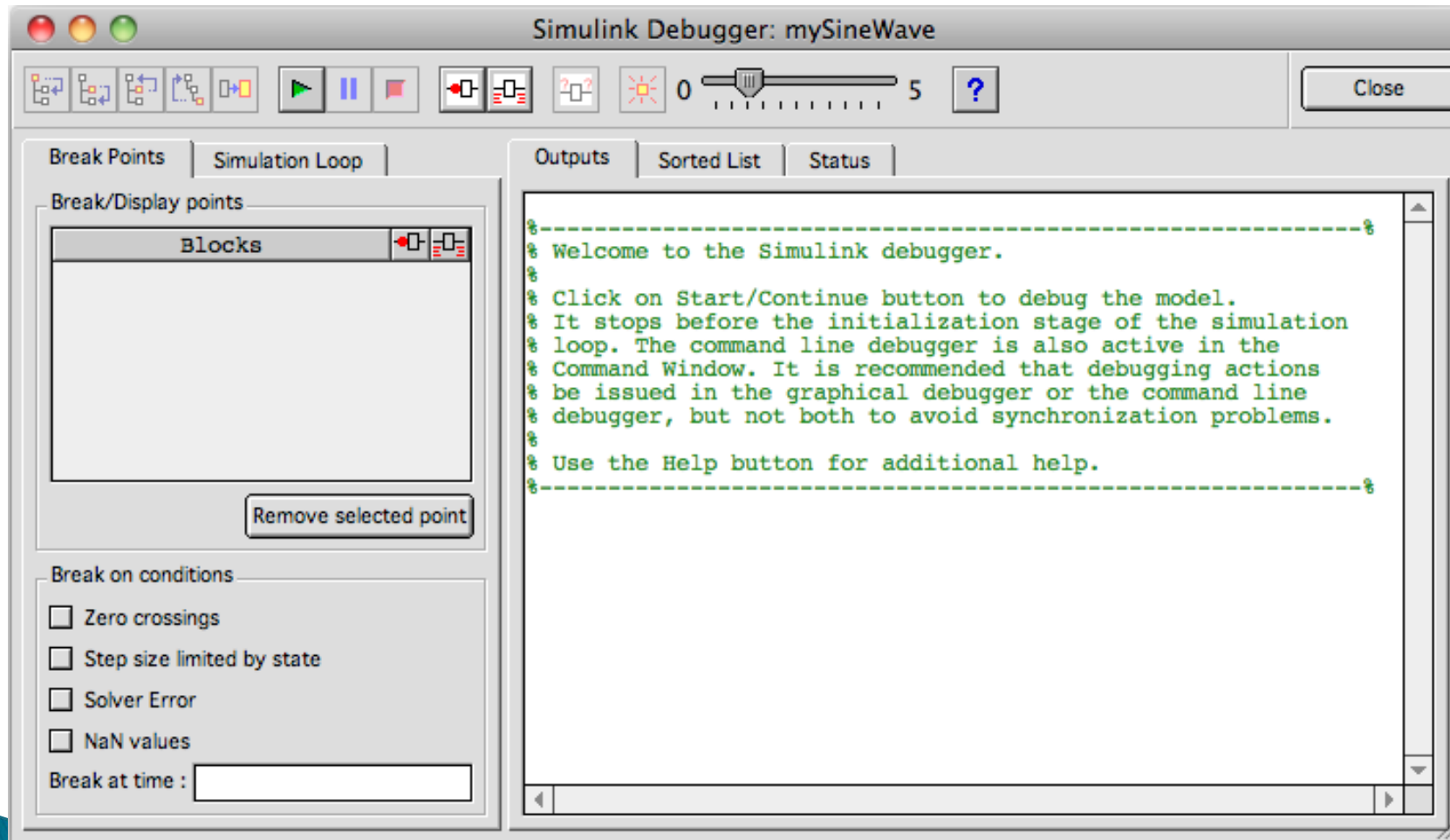


[http://en.wikipedia.org/wiki/Van\\_der\\_Pol\\_oscillator](http://en.wikipedia.org/wiki/Van_der_Pol_oscillator)

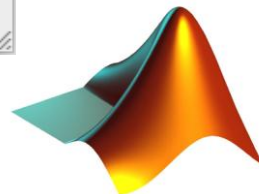
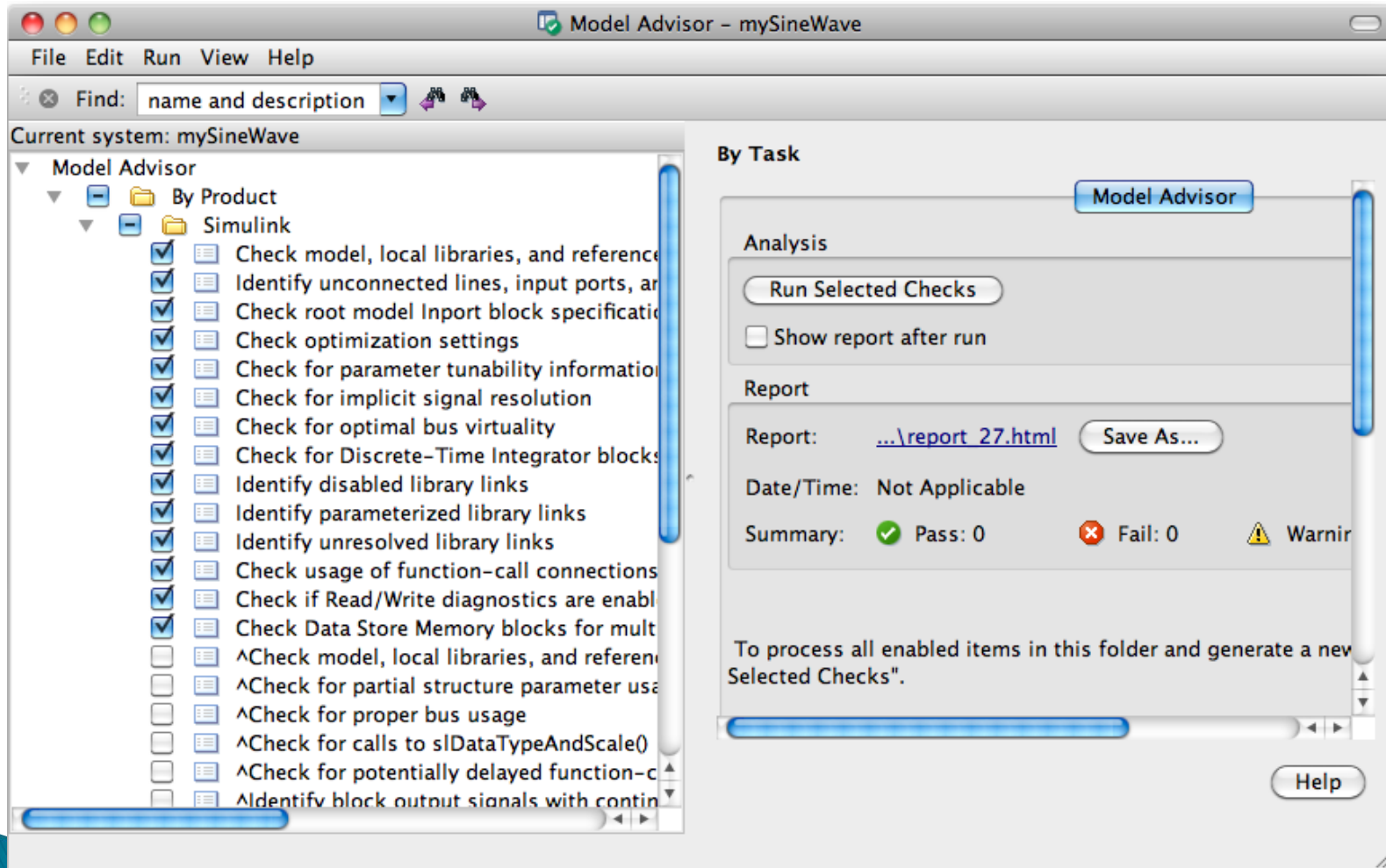




# Simulink Debugger

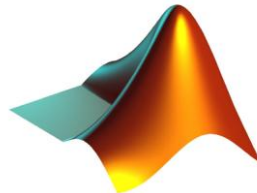


# Simulink Model Advisor



# Simulink Tips and Tricks

- ▶ Programmatically construct/manipulate Simulink models
  - New\_system, load\_system, Open\_system
  - Bdclose all
  - Find\_system
  - Sim
  - gcs
- ▶ Code generation
- ▶ <http://www.mathworks.com/products/rtwembedded/>



# References

Blog:

- ▶ Seth on Simulink <http://blogs.mathworks.com/seth/>

Documentation:

- ▶ <http://www.mathworks.com/access/helpdesk/help/toolbox/simulink/>

Model Reference:

- ▶ <http://www.mathworks.com/access/helpdesk/help/toolbox/simulink/ug/f4-141721.html>

Model Based Design

- ▶ <http://www.mathworks.com/model-based-design/>
- ▶ [http://en.wikipedia.org/wiki/Model\\_based\\_design](http://en.wikipedia.org/wiki/Model_based_design)

