Simulink

Introduction

Simulink is a software package that enables you to model, simulate, and analyze systems whose outputs change over time. Such systems are often referred to as dynamic systems. The Simulink software can be used to explore the behavior of a wide range of real-world dynamic systems, including electrical circuits, shock absorbers, braking systems, and many other electrical, mechanical, and thermodynamic systems. This section explains how Simulink works.

Simulating a dynamic system is a two-step process. First, a user creates a block diagram, using the Simulink model editor, that graphically depicts time-dependent mathematical relationships among the system's inputs, states, and outputs. The user then commands the Simulink software to simulate the system represented by the model from a specified start time to a specified stop time.

Block Diagram Semantics

A classic block diagram model of a dynamic system graphically consists of blocks and lines (signals). The history of these block diagram models is derived from engineering areas such as Feedback Control Theory and Signal Processing. A block within a block diagram defines a dynamic system in itself. The relationships between each elementary dynamic system in a block diagram are illustrated by the use of signals connecting the blocks. Collectively the blocks and lines in a block diagram describe an overall dynamic system.

The Simulink product extends these classic block diagram models by introducing the notion of two classes of blocks, nonvirtual blocks and virtual blocks. Nonvirtual blocks represent elementary systems. Virtual blocks exist for graphical and organizational convenience only: they have no effect on the system of equations described by the block diagram model. You can use virtual blocks to improve the readability of your models.
Creating an Empty Model

To create an empty model, click the **New** button on the Library Browser's toolbar, or choose **New** from the library window's **File** menu and select **Model**. An empty model is created in memory and it is displayed in a new model editor window.

Creating a Model Template

When you create a model, Simulink uses defaults for many configuration parameters. For example, by default new models have a white canvas, the **ode45** solver, and a visible toolbar. If these or other defaults do not meet your needs, you can use the Simulink software model construction commands described in **Model Construction** to write a function that creates a model with the defaults you prefer. For example, the following function creates a model that has a green canvas and a hidden toolbar, and uses the **ode3** solver:

```matlab
function new_model(modelname)
    % NEW MODEL Create a new, empty Simulink model
    % NEW_MODEL('MODELNAME') creates a new model with
    % the name 'MODELNAME'. Without the 'MODELNAME'
    % argument, the new model is named 'my_untitled'.

    if nargin == 0
        modelname = 'my_untitled';
    end

    % create and open the model
    open_system(new_system(modelname));

    % set default screen color
    set_param(modelname, 'ScreenColor', 'green');

    % set default solver
    set_param(modelname, 'Solver', 'ode3');

    % set default toolbar visibility
    set_param(modelname, 'Toolbar', 'off');

    % save the model
    save_system(modelname);
```
Selecting Objects

Selecting an Object
To select an object, click it. Small black square handles appear at the corners of a selected block and near the end points of a selected line. For example, the figure below shows a selected Sine Wave block and a selected line.

When you select an object by clicking it, any other selected objects are deselected.

Selecting Multiple Objects
You can select more than one object either by selecting objects one at a time, by selecting objects located near each other using a bounding box, or by selecting the entire model.

Selecting Multiple Objects One at a Time
To select more than one object by selecting each object individually, hold down the Shift key and click each object to be selected. To deselect a selected object, click the object again while holding down the Shift key.

Selecting Multiple Objects Using a Bounding Box
An easy way to select more than one object in the same area of the window is to draw a bounding box around the objects:

1. Define the starting corner of a bounding box by positioning the pointer at one corner of the box, then pressing and holding down the mouse button. Notice the shape of the cursor.

2. Drag the pointer to the opposite corner of the box. A dotted rectangle encloses the selected blocks and lines.

3. Release the mouse button. All blocks and lines at least partially enclosed by the bounding box are selected.

Selecting All Objects
Connecting Blocks

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Automatically Connecting Blocks

You can command the Simulink software to connect blocks automatically. This eliminates the need for you to draw the connecting lines yourself. When connecting blocks, the lines are routed around intervening blocks to avoid cluttering the diagram.

Connecting Two Blocks

To autoconnect two blocks:

1. Select the source block.

![Diagram of connecting two blocks automatically]

2. Hold down Ctrl and left-click the destination block.
   The source block is connected to the destination block, and the lines are routed around intervening blocks if necessary.

![Diagram of connecting two blocks automatically]

When connecting two blocks, the Simulink software draws as many connections as possible between the two blocks as illustrated in the following example.

![Diagram of connecting groups of blocks]

Connecting Groups of Blocks

Before autoconnect

After autoconnect
Aligning, Distributing, and Resizing Groups of Blocks Automatically

The model editor's Format menu includes commands that let you quickly align, distribute, and resize groups of blocks. To align (or distribute or resize) a group of blocks:

1. Select the blocks that you want to align.

One of the selected blocks displays empty selection handles. The model editor uses this block as the reference for aligning the other selected blocks. If you want another block to serve as the alignment reference, click that block.

2. Select one of the alignment options from the editor's Format > Align Blocks menu (or distribution options from the Format > Distribute Blocks or resize options from the Format > Resize Blocks menu). For example, selecting Align Top Edges aligns the top edges of the selected blocks with the top edge of the reference block.
Starting Simulink Software

To start the Simulink software, you must first start the MATLAB® technical computing environment. Consult your MATLAB documentation for more information. You can then start the Simulink software in two ways:

- On the toolbar, click the Simulink icon.
- Enter the sim command at the MATLAB prompt.

The Library Browser appears. It displays a tree-structured view of the Simulink block libraries installed on your system. You build models by copying blocks from the Library Browser into a model window (see Editing Blocks).

The Simulink library window displays icons representing the pre-installed block libraries. You can create models by copying blocks from the library into a model window.

**Note** On computers running the Windows® operating system, you can display the Simulink library window by right-clicking the Simulink node in the Library Browser window.
Panning Block Diagrams

You can use your keyboard alone (see Model Viewing Shortcuts) or in combination with your mouse to pan model diagrams that are too large to fit in the Model Editor's window. To use the keyboard and the mouse, position the mouse over the diagram, hold down the p or q key on the keyboard, then hold down the left mouse button.

**Note** You must press and hold down the key first and then the mouse button. The reverse does not work.

A pan cursor appears.

Moving the mouse now pans the model diagram in the editor window.

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Reference
Mat lab 2009b Help