APPENDIX VI

INTRODUCTION TO MATLAB SIMULINK

➢ INTRODUCTION

SIMULINK is a powerful graphical Simulation technique that is linked to MATLAB and which allows study of a dynamical system in block diagram form. Simulink has a library containing varied elements of the block diagrams and a number of tools to perform various tasks.

➢ SIMULATION STEPS

Simulation is technique that involves setting up a model of a real situation and performing analysis and experiments on the model in real time before actually building system. Simulation of a system involves are the following steps:

- Observing the physical system
- Formulating a mathematical model
- Predicting the Behaviour of the system
- Testing the validity of the model

➢ TYPES OF MATHEMATICAL MODEL

Mathematical models can be classified in many ways as characterized below:
1. **Linear or Non-linear Model**
   - Linear model: A model which obeys principles of superposition
   - Non-Linear model: A model which possess mathematical relations that are not linear

2. **Lumped or Distributed Parameter Model**
   - Lumped parameter model: A model that is described by ordinary differential equation with only one independent variable
   - Distributed parameter model: A model which is described by partial differential equation with two or more independent variables

3. **Static or Dynamic Model**
   - Static model: A model which does not take time variation into account
   - Dynamic model: A model which has time variant characteristics

4. **Continuous or Discrete Model**
   - Continuous model: A model in which dependent variables are continuous in time
   - Discrete model: A model in which equations are described at distinct instances of time
Simulink has built-in blocks under different libraries such as continuous, discrete, math operations; sink sources, etc. to facilitate the user to simulate a system as per the requirement.

STARTING SIMULINK

Obtain MATLAB command window, shown in Figure A 6.1, by double clicking the MATLAB icon on the screen, alternatively, access the window by clicking the start button on the bottom left-hand corner of the PC, dragging the cursor to program and then to MATLAB. In the MATLAB command prompt line (>>) type Simulink and hit the enter key. The Simulink library browser will pop up as shown in Figure A 6.2.

Figure A6.1 MATLAB desktop showing simulink icon on toolbar
The content of each block set can be explored by clicking on the + sign at the beginning of each toolbox. Different blocks are categorized in different sub-libraries of Simulink. Figure A6.3 and Figure A6.4 shows blocks available in Continuous and Math Operations sub-libraries. Function like derivative, integral, transfer function, transport delay, etc. are available under the Continuous library, whereas different mathematical operations such as Abs, Add, Divide, Gain, etc. are available under the Math Operations library.
Figure A6.3 Blocks available in continuous sub-libraries
Figure A6.4 Blocks available in math operations sub-libraries

- CREATING A NEW MODEL

A new model can be created using standard method similar to creating new file in MS Window environment as follows.

1. By clicking on the **New Model** icon from the toolbar of Simulink Library Browser.
2. By selecting **New Model** from the **File** menu of Simulink Library Browser.

3. By pressing **Ctrl+N** keys at the active Simulink Library Browser.

A new model window will appear on the screen with untitled as its default name as shown in Figure A6.5. The user can create and simulate the desired model in this window.

![New untitled model window](image)

**Figure A6.5** New untitled model window

OPENING AN EXISTING MODEL

An existing model can also be opened using the standard method similar to opening an existing file in Microsoft Windows environment as follows:
1. By clicking on the **Open model** icon 📀 from the toolbar of Simulink Library Browser

2. By Selecting **Open** option from the **File** menu of Simulink Library Browser.

3. By pressing **Ctrl+O** keys at the active Simulink Library Browser.

   A new Open dialog box will appear on the screen. The desired model file can be opened by selecting its location.

 ➢ **CREATING AND SIMULATING A SIMULINK MODEL**

   Once a new Simulink model window appears as shown as Figure A6.5, user can create a Simulink model of a desired system by selecting different blocks from the Simulink Library.

   The various steps involved to create a Simulink model are as follows.

   1. Describe the mathematical model of the system.

   2. Select the independent / dependent variables.

   3. Open a new model from the file menu.

   4. Copy different blocks from library on to the model.

   5. Arrange different blocks and connect them.
6. Specify/Define internal parameters of each block. A user can enter required information as constant or as named variables in workspace:

- By typing directly.
- By reading a data file or running an M-file.

7. Save the model.

8. Simulate the model and observe results.