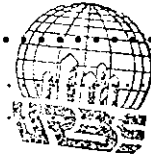


Contents

| | |
|--------------------------------------------------------------------|-----------|
| Preface | xi |
| To the Instructor | xi |
| Technical Support for Instructors | xii |
| Other Information Sources for Instructors and Students | xii |
| MATLAB based Books | xii |
| Acknowledgments | xiii |
| | |
| 1. Getting Started | 1 |
| 1.1 To the Student | 1 |
| 1.1.1 What Is SIMULINK? | 2 |
| 1.1.2 What's New in SIMULINK 2? | 3 |
| 1.1.3 How to Use this Manual | 3 |
| 1.1.4 Comparing The Student Edition to Professional SIMULINK | 4 |
| 1.1.5 Upgrading to Professional SIMULINK | 5 |
| 1.1.6 Technical Support | 5 |
| 1.2 SIMULINK for Windows 95/NT | 7 |
| 1.2.1 System Requirements | 7 |
| 1.2.2 Installing SIMULINK for Windows 95/NT | 7 |
| 1.3 SIMULINK for Macintosh | 8 |
| 1.3.1 System Requirements | 8 |
| 1.3.2 Installing SIMULINK for Macintosh | 8 |
| | |
| 2. Quick Start | 11 |
| 2.1 Introduction | 11 |
| 2.1.1 Typographical Conventions | 11 |
| 2.2 Building a Simple Model | 12 |
| 2.3 A More Complicated Model | 17 |
| 2.4 The SIMULINK Help System | 26 |
| 2.4.1 Opening the Block Browser | 28 |
| 2.4.2 Block Browser Window | 28 |
| 2.5 Summary | 29 |
| 2.6 Reference | 29 |



| | |
|---------------------------------------------------|-----------|
| 3. Model Building | 31 |
| 3.1 Introduction | 31 |
| 3.1.1 Elements of a model | 31 |
| 3.2 Opening a Model | 32 |
| 3.3 Manipulating Blocks | 33 |
| 3.3.1 Resizing a Block | 33 |
| 3.3.2 Rotating a Block | 34 |
| 3.3.3 Copying a Block Within a Model | 34 |
| 3.3.4 Deleting Blocks | 35 |
| 3.3.5 Selecting Multiple Blocks | 35 |
| 3.3.6 Changing a Block Label | 36 |
| 3.3.7 Changing Label Location | 38 |
| 3.3.8 Hiding a Label | 38 |
| 3.3.9 Adding a Drop Shadow | 39 |
| 3.3.10 Configuring Blocks | 39 |
| 3.4 Signal Lines | 39 |
| 3.4.1 Drawing Signal Lines at an Angle | 39 |
| 3.4.2 Moving a Segment | 41 |
| 3.4.3 Moving a Vertex | 42 |
| 3.4.4 Deleting a Signal Line | 42 |
| 3.4.5 Splitting a Signal Line | 43 |
| 3.4.6 Labeling a Signal Line | 44 |
| 3.4.7 Moving or Copying a Signal Line Label | 45 |
| 3.4.8 Editing a Signal Line Label | 46 |
| 3.4.9 Signal Label Propagation | 46 |
| 3.5 Annotations | 48 |
| 3.5.1 Adding Annotations | 48 |
| 3.5.2 Changing Annotation Fonts | 48 |
| 3.6 Adding Sources | 48 |
| 3.6.1 Common Sources | 49 |
| 3.6.2 From Workspace Block | 51 |
| 3.7 Adding Sinks | 53 |
| 3.7.1 Scope Block | 53 |
| 3.7.2 XY Graph | 58 |
| 3.8 Configuring the Simulation | 58 |
| 3.8.1 Solver Page | 59 |
| 3.8.2 Workspace I/O Page | 62 |
| 3.8.3 Diagnostics Page | 64 |
| 3.9 Running a Simulation | 67 |
| 3.10 Printing a Model | 67 |

| | | |
|-----------|-------------------------------------------|------------|
| 3.10.1 | Printing to the Printer Using Menus | 67 |
| 3.10.2 | Embedding the Model in a Document | 67 |
| 3.10.3 | Using the MATLAB print Command | 68 |
| 3.11 | Model-Building Summary | 70 |
| 3.12 | Summary | 72 |
| 3.13 | References | 72 |
| 4. | Continuous Systems | 73 |
| 4.1 | Introduction | 73 |
| 4.2 | Scalar Linear Systems | 73 |
| 4.2.1 | Integrator Block | 73 |
| 4.2.2 | Transfer Function Blocks | 78 |
| 4.3 | Vector Linear Systems | 80 |
| 4.3.1 | Vector Signal Lines | 81 |
| 4.3.2 | State-Space | 82 |
| 4.3.3 | State-Space Block | 85 |
| 4.4 | Modeling Nonlinear Systems | 87 |
| 4.4.1 | Function Blocks | 90 |
| 4.5 | Summary | 95 |
| 4.6 | References | 95 |
| 5. | Discrete-Time Systems | 97 |
| 5.1 | Introduction | 97 |
| 5.1.1 | Discrete-Time System Overview | 97 |
| 5.2 | Scalar Linear Discrete-Time Systems | 99 |
| 5.2.1 | Unit Delay | 100 |
| 5.2.2 | Discrete-Time Integrator | 101 |
| 5.2.3 | Discrete Transfer Function Blocks | 105 |
| 5.3 | Logical Blocks | 107 |
| 5.4 | Vector Discrete-time Systems | 110 |
| 5.5 | Multirate Discrete-time Systems | 111 |
| 5.6 | Hybrid Systems | 114 |
| 5.7 | Summary | 117 |
| 5.8 | References | 117 |
| 6. | Subsystems and Masking | 119 |
| 6.1 | Introduction | 119 |

| | | |
|-----------|------------------------------------------------------|------------|
| 6.2 | SIMULINK Subsystems | 119 |
| 6.2.1 | Encapsulating a Subsystem | 121 |
| 6.2.2 | Subsystem Blocks | 123 |
| 6.3 | Masked Blocks | 126 |
| 6.3.1 | Converting a Subsystem into a Masked Subsystem | 128 |
| 6.3.2 | Mask Editor Documentation Page | 128 |
| 6.3.3 | Mask Editor Initialization Page | 130 |
| 6.3.4 | Mask Editor Icon Page | 139 |
| 6.3.5 | Looking Under and Removing Masks | 146 |
| 6.3.6 | Using Masked Blocks | 147 |
| 6.3.7 | Creating a Block Library | 147 |
| 6.4 | Conditionally Executed Subsystems | 149 |
| 6.4.1 | Enabled Subsystems | 149 |
| 6.4.2 | Triggered Subsystems | 153 |
| 6.4.3 | Triggered and Enabled Subsystems | 155 |
| 6.4.4 | Discrete Conditionally Executed Subsystems | 155 |
| 6.5 | Summary | 156 |
| 6.6 | Reference | 156 |
| 7. | SIMULINK Analysis Tools | 157 |
| 7.1 | Introduction | 157 |
| 7.2 | Determining Model Characteristics | 157 |
| 7.2.1 | SIMULINK State Vector Definition | 157 |
| 7.2.2 | Using the model Command | 158 |
| 7.3 | Executing Models from MATLAB | 162 |
| 7.3.1 | Using sim to Run a Simulation | 162 |
| 7.3.2 | Setting Simulation Parameters with simset | 165 |
| 7.3.3 | Getting Simulation Parameters with simget | 168 |
| 7.4 | Linearization Tools | 173 |
| 7.4.1 | Linearization | 173 |
| 7.4.2 | SIMULINK Linearization Commands | 175 |
| 7.5 | Trim Tools | 184 |
| 7.6 | Summary | 191 |
| 7.7 | References | 192 |
| 8. | Numerical Issues | 193 |
| 8.1 | Introduction | 193 |
| 8.2 | Choosing a Solver | 193 |
| 8.3 | Algebraic Loops | 200 |

| | | |
|----------------------------------------|-----------------------------------|------------|
| 8.3.1 | Newton-Raphson Method | 201 |
| 8.3.2 | Eliminating Algebraic Loops | 202 |
| 8.4 | Summary | 207 |
| 8.5 | References | 207 |
| Appendix: Block Reference | | 209 |
| | SIMULINK Block Library | 209 |
| | Sources Block Library | 210 |
| | Sinks Block Library | 211 |
| | Discrete Block Library | 212 |
| | Linear Block Library | 213 |
| | Nonlinear Block Library | 214 |
| | Connections Block Library | 218 |
| Index | | 221 |