

Contents

Preface	ix
I MATLAB Programming	1
1 Getting Started	3
1.1 Running the MATLAB IDE	4
Manipulating windows	4
1.2 MATLAB variables	5
Variable assignment statements	7
Variable names	8
Variable workspace	9
1.3 Numbers and functions	9
1.4 Documentation	11
1.5 Writing simple MATLAB scripts	11
1.6 A few words about errors and debugging	14
1.7 Using the debugger	14
2 Strings and Vectors	20
2.1 String basics	21
2.2 Using the <code>disp</code> command to print a variable's value	22
2.3 Getting information from the user	22
2.4 Vectors	23
2.5 Operations on vectors	24
2.6 Special vector functions	27
Statistical functions	28
2.7 Using <code>rand</code> and <code>randi</code>	29
3 Plotting	34
3.1 The <code>plot</code> command	35
3.2 Tabulating and plotting a simple function	39
3.3 Bar graphs and histograms	43
3.4 Drawing several plots on one graph	46
Multiple plots with a single <code>plot</code> command	46
Combining multiple plots with a <code>hold</code> command	48
3.5 Adding lines and text	51

4	Matrices	56
4.1	Entering and manipulating matrices	57
4.2	Operations on matrices	60
4.3	Solving linear systems: The backslash operator	65
	Extended example: Solving circuit problems	66
4.4	Special matrix functions	72
5	Control Flow Commands	75
5.1	Conditional execution: The <code>if</code> statement	76
5.2	Logical expressions	79
5.3	Logical variables	81
5.4	<code>for</code> loops	82
5.5	<code>while</code> loops	85
5.6	Other control flow commands	87
	Switch-case statement	87
	Break statement (not recommended)	88
6	Animation	94
6.1	Basic animation	95
6.2	Animating function plots	99
6.3	Kinematics of motion	103
	One-dimensional motion: Constant speed	103
	Motion with constant acceleration	106
	Time-marching dynamics: Nonconstant force	109
7	Writing Your Own MATLAB Functions	117
7.1	MATLAB function files	118
	Declaring MATLAB functions	119
7.2	Function inputs and outputs	120
7.3	Local workspaces	120
7.4	Multiple outputs	121
7.5	Function files	121
7.6	Other functional forms	121
	Subfunctions	122
	Nested functions	127
	Anonymous functions	128
8	More MATLAB Data Classes and Structures	137
8.1	Cell arrays	138
8.2	Structures	139
8.3	Complex numbers	140
8.4	Function handles	141
8.5	Other data classes and data structures	141

II Building GUI Tools	145
9 Building a Graphical User Interface	147
9.1 Getting started with GUIDE.....	147
Saving the GUI to a file.....	150
9.2 Starting an action with a GUI element.....	151
9.3 Communicating with GUI elements.....	154
Building SliderTool.....	154
Communicating with GUI elements from the command line.....	157
9.4 Synchronizing information with a GUI element.....	161
9.5 Key points from this chapter.....	163
10 Transforming a MATLAB Program into a GUI Tool	165
10.1 Creating a GUI tool step by step.....	166
10.2 Further GUI design considerations.....	177
11 GUI Components	189
III Advanced Topics	207
12 More GUI Techniques	209
12.1 Waitbars.....	210
12.2 File dialogs.....	211
Saving and loading data in .mat files.....	211
A GUI interface to file names using uinputfile and uigetfile.....	212
12.3 Reading and writing formatted text files.....	215
12.4 The input dialog.....	219
12.5 The question dialog.....	220
12.6 Sharing application data between functions.....	221
12.7 Responding to keyboard input.....	222
12.8 Making graphic objects interactive.....	223
Mouse-click response.....	223
Mouse events and object dragging.....	225
12.9 Creating menus in GUIDE.....	228
13 More Graphics	232
13.1 Logarithmic plots.....	233
13.2 Plotting functions on two axes.....	236
13.3 Plotting surfaces.....	237
13.4 Plotting vector fields.....	243
13.5 Working with images.....	245
Importing and manipulating bit-mapped images.....	245
Placing images on surface objects.....	253
13.6 Rotating composite objects in three dimensions.....	254

14 More Mathematics	260
14.1 Derivatives	261
Derivatives of mathematical functions expressed as MATLAB functions	261
Derivatives of tabulated functions	263
14.2 Integration	265
Integrating tabulated functions	265
Integrating mathematical functions expressed as MATLAB functions	270
14.3 Zeros of a function of one variable	273
14.4 Function minimization	275
Finding a minimum of a function of one variable	275
Multidimensional minimization	277
Fitting to an arbitrary function by multidimensional minimization	278
Solving simultaneous nonlinear equations by multidimensional minimization	281
14.5 Solving ordinary differential equations	284
14.6 Eigenvalues and eigenvectors	289
Appendix A: Hierarchy of Handle Graphics Objects	293
Appendix B: Using L^AT_EX Commands	295
Index	301