Table of Contents

Preface xiii
1. Why IDL? xiii
2. Who is this book for? xiii
3. How this book is organized xiv
4. Example code xvi
5. Developers from other languages xvi
6. How to contact me xvii
7. Acknowledgments xvii
1. Introduction to IDL 1
1.1. Getting starting with IDL 1
1.2. Read and display an image 3
1.3. Visualizing 3-dimensional geometry 6
1.4. More examples 7
1.5. Summary 9
2. The IDL environment 11
2.1. The IDL command line 11
2.2. Executive commands 12
2.3. Preferences 13
2.4. The IDL Workbench 16
3. Variables 25
3.1. Introduction 25
3.2. Variable names 25
3.3. Variable types 26
3.4. Arrays 29
3.5. Structures 35
3.6. Operators 39
3.7. Variable information 43
3.8. Strings 43
3.9. Regular expressions 47
3.10. System variables 53
3.11. Pointers 56
3.12. Objects 64
3.13. Lists and hashes 65
3.14. Common blocks 70
3.15. Shared memory 72
3.16. Summary 74
4. File Input/Output 77
4.1. Handling files 77
4.2. Supported file formats 79
4.3. High-level input and output routines 82
4.4. Low-level input and output routines 85
4.5. *.sav* files 93
4.6. Scientific data formats: HDF5 overview 95

4.7. Video 103
4.8. Networking 104
4.9. XML 105
4.10. Summary 108
5. Programming 111
5.1. Introduction 111
5.2. Looping constructs 111
5.3. Truth and conditionals 115
5.4. Routines 117
5.5. Error handling 123
5.6. Debugging 126
5.7. Main-level programs 127
5.8. Batch files 128
5.9. The `compile_opt` statement 129
5.10. Distribution of IDL code 132
5.11. Summary 133
6. Direct graphics 135
6.1. Direct graphics vs. object graphics 135
6.2. Color 136
6.3. Handling graphics windows 141
6.4. Line plots 143
6.5. Coordinate systems 150
6.6. Annotation 152
6.7. Images 156
6.8. Surface plots 161
6.9. Contour plots 163
6.10. Combining 3-dimensional plots 166
6.11. Maps 168
6.12. Polygonal meshes 170
6.13. Vector fields 172
6.14. Volumes 175
6.15. Animation 178
6.16. Graphics devices 181
6.17. Summary 187
7. Objects 191
7.1. Concepts 192
7.2. Writing a class 192
7.3. Inheritance 198
7.4. Operator overloading 201
7.5. Tricks and techniques 205
7.6. For those familiar with other object-oriented languages 206
8. Widgets 209
8.1. Introduction 209
8.2. Simple example: MG_XPLOT 210
8.3. Widget programming details 215
8.4. A more complicated example: MG_XIMAGE 216

8.5. Dialogs 223
8.6. Compound widgets 225
8.7. Object widgets 229
8.8. Summary 240
9. Object graphics 243
9.1. Introduction 243
9.2. Displaying an image in object graphics 243
9.3. The theory 245
9.4. A 3-dimensional example 249
9.5. The transformation matrix 253
9.6. Properties 256
9.7. Sample visualizations 257
9.8. Texture mapping and transparency 274
9.9. Inheriting from an *IDLgr* class: *MGgrCube* 278
9.10. Composite graphics classes 282
9.11. Sending output to other destinations 283
9.12. Creating a new destination: *MGgrWindow3D* 284
9.13. Widgets and objects graphics: interaction 289
9.14. Widgets and object graphics: tiled imagery 293
9.15. Function graphics 301
9.16. Summary 316
10. Using the iTools 319
10.1. What are the iTools? 319
10.2. iTools basics 320
10.3. Advanced iTools features 324
10.4. Scripting the iTools 326
10.5. Summary 332
11. Performance 333
11.1. Introduction 333
11.2. Timing 334
11.3. Vectorization 336
11.4. Logic 343
11.5. Array and matrix techniques 345
11.6. The clever use of HISTOGRAM 349
11.7. Memory usage 357
11.8. Object-oriented techniques 359
11.9. Summary 362
12. External development 363
12.1. Techniques 363
12.2. SPAWN 364
12.3. CALL_EXTERNAL 365
12.4. Dynamically loadable modules 366
12.5. Bridges 375
12.6. Python 377
12.7. Summary 378
A. Resources 381

A.1. Online help 381
A.2. Resources in the IDL distribution 381
A.3. Resources on the Internet 382
A.4. Books on IDL 382
A.5. IDL code libraries 383
A.6. IDL open source projects 384
B. Starting IDL 385
C. A style guide 389
C.1. General principles 389
C.2. Layout 390
C.3. Comments 391
C.4. Statement formatting 393
C.5. Variables 396
C.6. Routines 397
C.7. Object-oriented programming 398
D. The IDL library 401
D.1. Animation 401
D.2. Application development 401
D.3. Arrays 402
D.4. Color 403
D.5. Date and time 404
D.6. Debugging 405
D.7. Dialogs 405
D.8. Error handling 406
D.9. External development 406
D.10. File input/output 406
D.11. Fonts 408
D.12. Images 409
D.13. Internationalization 412
D.14. Introspection 412
D.15. Mapping 413
D.16. Mathematics 414
D.17. Networking 422
D.18. Object library 423
D.19. OS access 423
D.20. Plotting 424
D.21. Profiling 426
D.22. Signal processing 426
D.23. Statistics and probability 427
D.24. Strings 429
D.25. Structures 430
D.26. Type 430
D.27. Vector fields 430
D.28. Wavelet Toolkit 431
D.29. Widgets 432
D.30. Windows 434

Glossary 435
Index 445