

1. Extending Ptolemy — Introduction	1-1
1.1 Introduction.....	1-1
1.2 File Organization.....	1-1
Ptolemy environment variables	1-2
Directory Structure	1-3
1.3 Creating Custom Versions of pigIRpc	1-6
Creating a pigIRpc that includes your own stars	1-7
Creating a pigIRpc with more extensive customizations	1-8
1.4 Using mkPtolemyTree to create a custom Ptolemy trees. 1-9	
mkPtolemyTree example	1-9
How mkPtolemyTree works	1-10
Combining mkPtolemyTree and pigIExample	1-11
Known Bugs in mkPtolemyTree	1-11
1.5 Using csh aliases to create a Parallel Software Development Tree	
1-12	
Aliases for Managing Symbolic Links	1-12
Creating a Duplicate Hierarchy	1-16
Source Code Control	1-18
1.6 Building standalone programs that use Ptolemy libraries.1-19	
Standalone example using StringList	1-19
Standalone example that tests a Scheduler	1-20
1.7 Debugging Ptolemy and Extensions Within Pigi.....	1-21
A quick scan of the stack	1-22
More extensive debugging	1-23
Debugging hints	1-25
2. Writing Stars for Simulation.....	2-1
2.1 Introduction.....	2-1
2.2 Adding stars dynamically to Ptolemy.....	2-1
2.3 The Ptolemy preprocessor language (ptlang)	2-3
Invoking the preprocessor	2-4
An example	2-4
Items that appear in a defstar	2-5
2.4 Writing C++ code for stars.....	2-16
The structure of a Ptolemy star	2-17
Reading inputs and writing outputs	2-17
States	2-21
Array States	2-23
2.5 Modifying PortHoles and States in Derived Classes....	2-26
2.6 Programming examples.....	2-26
2.7 Preventing Memory Leaks in C++ Code.....	2-28
3. Infrastructure for Star Writers.....	3-1

3.1	Introduction	3-1
3.2	Handling Errors	3-1
3.3	I/O Classes	3-2
	Extended input and output stream classes	3-2
	Generating graphs using the XGraph class	3-3
	Classes for displaying animated bar graphs	3-4
	Collecting statistics using the histogram classes	3-5
3.4	String Functions and Classes	3-8
3.5	Iterators	3-10
3.6	List Classes	3-11
3.7	Hash Tables	3-13
3.8	Sharing Data Structures Across Multiple Stars	3-14
3.9	Using Random Numbers	3-17
4.	Data Types	4-1
4.1	Introduction	4-1
4.2	Scalar Numeric Types	4-1
	The Complex data type	4-1
	The fixed-point data type	4-3
4.3	Defining New Data Types	4-14
	Defining a new Message class	4-15
	Use of the Envelope class	4-17
	Use of the MessageParticle class	4-18
	Use of messages in stars	4-18
4.4	The Matrix Data Types	4-21
	Design philosophy	4-21
	The PtMatrix class	4-22
	Public functions and operators for the PtMatrix class	4-22
	Writing stars and programs using the PtMatrix class	4-29
	Future extensions	4-33
4.5	The File and String Types	4-34
	The File type	4-34
	The String type	4-35
4.6	Writing Stars That Manipulate Any Particle Type	4-35
4.7	Unsupported Types	4-37
	Sub-matrices	4-37
	Image particles	4-40
	“First-class” types	4-41
5.	Using Tcl/Tk	5-1
5.1	Introduction	5-1
5.2	Writing Tcl/Tk scripts for the TclScript star	5-1
5.3	Tcl utilities that are available to the programmer	5-6

5.4	Creating new stars derived from the TclScript star.	5-11
5.5	Selecting colors	5-12
5.6	Writing Tcl stars for the DE domain	5-12
6.	Using the Cluster Class for Scheduling	6-1
6.1	Introduction	6-1
6.2	Basic Classes	6-1
6.3	Galaxies and their relationship to Adjacency Lists.	6-1
6.4	Clustering	6-2
	Initialization — Flattening the User Specified Graph	6-2
	Absorb and Merge	6-3
	Cluster Iterator Classes	6-5
6.5	Block state and name scoping hierarchy	6-6
6.6	Resetting an InterpUniverse back to actionList.	6-6
6.7	References.	6-7
7.	SDF Domain	7-1
7.1	Introduction	7-1
7.2	Setting SDF porthole parameters	7-1
8.	DDF Domain	8-1
8.1	Programming Stars in the DDF Domain	8-1
9.	BDF Domain	9-1
9.1	Writing BDF Stars	9-1
10.	PN domain	10-1
10.1	Introduction	10-1
10.2	Processes	10-3
	The PtThread Class	10-3
	The PosixThread Class	10-4
	The DataFlowProcess Class	10-6
10.3	Communication Channels	10-7
	PtGate	10-8
	PosixMonitor	10-8
	CriticalSection	10-8
	PtCondition	10-9
	PosixCondition	10-9
	PNGeodesic	10-10
10.4	Scheduling.	10-12
	ThreadList	10-12
	PNScheduler	10-12
10.5	Programming Stars in the PN Domain	10-15

11. SR domain	11-1
11.1 Introduction	11-1
11.2 Communication in SR	11-1
11.3 Strict and non-strict SR stars	11-2
12. DE Domain.....	12-1
12.1 Introduction	12-1
12.2 Programming Stars in the DE Domain.....	12-1
Delay stars	12-2
Functional Stars	12-4
Sequencing directives	12-6
Simultaneous events	12-7
Non-deterministic loops	12-8
Source stars	12-8
12.3 Phase-Based Firing Mode	12-11
12.4 Programming Examples	12-13
Identity Matrix Star	12-13
Matrix Transpose	12-14
13. Code Generation	13-1
13.1 Introduction	13-1
13.2 Writing Code Generation Stars.....	13-2
Codeblocks	13-3
Codeblocks with arguments	13-5
In-line codeblocks	13-7
Macros	13-8
Assembly PortHoles	13-12
Attributes	13-12
Possibilities for effective buffering	13-14
13.3 Targets	13-16
Single-processor target	13-16
Assembly code streams	13-17
Multiprocessor targets	13-18
13.4 Schedulers	13-20
Single-processor schedulers	13-20
Multiprocessor schedulers	13-21
13.5 Interface Issues	13-25
14. CGC Domain.....	14-1
14.1 Introduction	14-1
14.2 Code Generation Methods.....	14-1
14.3 Buffer Embedding	14-2
14.4 Command-line Settable States	14-3

	C code generated to support command line arguments	14-3
	Changes in pigIRpc to support command line arguments	14-4
	Limitations of command line arguments.	14-5
14.5	CGC Compile-time Speed	14-6
14.6	BDF Stars	14-6
14.7	Tcl/Tk Stars	14-7
14.8	Tycho Target	14-8
15.	CG56 Domain	15-1
15.1	Introduction	15-1
15.2	Data Types	15-1
15.3	Attributes	15-1
15.4	Code Streams	15-2
	Sim56Target Code Streams	15-2
	S56XTarget/S56XTargetWH Code Streams	15-2
16.	C50 Domain	16-1
16.1	Introduction	16-1
16.2	Data Types	16-1
16.3	Attributes	16-1
16.4	Code Streams	16-1
16.5	Symbols	16-2
16.6	Reserved Memory	16-2
17.	Creating New Domains	17-1
17.1	Introduction	17-1
17.2	A closer look at the various classes	17-2
	Target	17-3
	Domain	17-3
	Star	17-3
	PortHole	17-3
	Geodesic	17-5
	Plasma	17-5
	Particle	17-5
	Scheduler	17-6
17.3	What happens when a Universe is run	17-6
17.4	Recipe for writing your own domain	17-9
	Introduction	17-9
	Creating the files	17-9
	Required classes and methods for a new domain	17-9
	Building an object directory tree	17-10
INDEX		I-1

