CONTENTS

About the Authors *xi*

Foreword *xv*

Introduction *xvii*

Chapter 1 The Propeller Chip Multicore Microcontroller *1*

Introduction *1*
Multicore Defined *2*
Why Multicore? *3*
Multicore Propeller Microcontroller *3*
Summary *14*
Exercises *14*

Chapter 2 Introduction to Propeller Programming *15*

Introduction *15*
What's the Secret? *16*
Ready to Dive In? *17*
Let's Get Connected! *17*
Your First Propeller Application *22*
A Blinking LED *25*
RAM versus EEPROM *27*
A More Powerful Blink *28*
All Together Now *32*
Wrapping It Up *34*
Timing Is Everything *38*
Sizing the Stack *41*
Propeller Objects and Resources *45*
Summary *48*
Exercises *49*

Chapter 3 Debugging Code for Multiple Cores *51*

Propeller Features That Simplify Debugging *52*
Object Design Guidelines *56*
Common Multiprocessor Coding Mistakes *58*
Survey of Propeller Debugging Tools *78*
Debugging Tools Applied to a Multiprocessing Problem *86*
Summary *116*
Exercises *117*

Chapter 4 Sensor Basics and Multicore Sensor Examples ***119***
Introducing Sensors by Their Microcontroller Interfaces *119*
On/Off Sensors *122*
Resistive, Capacitive, Diode, Transistor, and Other *137*
Pulse and Duty Cycle Outputs *144*
Frequency Output *153*
Voltage Output *156*
Synchronous Serial *168*
Asynchronous Serial *174*
Questions about Processing and Storing Sensor Data *182*
Summary *187*
Exercises *188*

Chapter 5 Wirelessly Networking Propeller Chips ***189***
Introduction *189*
Overview of Networking and XBee Transceivers *191*
Hardware Used in This Chapter *193*
Testing and Configuring the XBee *193*
Sending Data from the Propeller to the PC *204*
Polling Remote Nodes *208*
Using the XBee API Mode *214*
A Three-Node, Tilt-Controlled Robot with Graphical Display *221*
Summary *231*
Exercise *232*

Chapter 6 DanceBot, a Balancing Robot ***235***
Introduction *235*
The Challenge *235*
Building the DanceBot *238*
Controlling the DanceBot *255*
Summary *255*
Exercises *255*

Chapter 7 Controlling a Robot with Computer Vision ***257***
Introduction *257*
Understanding Computer Vision *258*
PropCV: A Computer Vision System for the Propeller *259*
Apply Filters and Track a Bright Spot in Real Time *265*
Following a Line with a Camera *270*
Track a Pattern *272*
State-of-the-Art Computer Vision with OpenCV *274*
OpenCV and Propeller Integration *276*
Summary *279*
Exercises *280*

Chapter 8 Using Multicore for Networking Applications ***281***
Introduction *281*
Ethernet and Internet Protocols *281*
EtherX Add-in Card for the Propeller-Powered HYDRA *287*

Creating a Simple Networked Game *312*
Summary *318*
Exercises *318*

Chapter 9 Portable Multivariable GPS Tracking and Data Logger *319*
Introduction *319*
Overview of the Sensors *322*
Main Spin Object *344*
Experiment *346*
Summary *351*
Exercises *352*

Chapter 10 Using the Propeller as a Virtual Peripheral for Media Applications *353*
Introduction *353*
Overview, Setup, and Demo *354*
System Architecture and Constructing the Prototype *362*
Remote Procedure Call Primer *366*
Virtual Peripheral Driver Overview *370*
Client/Host Console Development *372*
Exploring the Command Library to the Slave/Server *387*
Enhancing and Adding Features to the System *389*
Exploring Other Communications Protocols *389*
Summary *396*
Exercises *396*

Chapter 11 The HVAC Green House Model *399*
Introduction *399*
Exploring the Problem *400*
The HVAC Green House Model *402*
Summary *423*
Exercises *425*

Chapter 12 Synthesizing Speech with the Propeller *427*
Introduction *427*
Using Spectrographs to “See” Speech *427*
Exploring the VocalTract Object *431*
Summary *441*
Exercises *442*

Appendix A Propeller Language Reference *443*
Categorical Listing of Propeller Spin Language Elements *443*
Categorical Listing of Propeller Assembly Language *449*
Reserved Word List *457*

Appendix B Unit Abbreviations *459*

Index *463*