Motors and Drives

A Practical Technology Guide

Dave Polka

ISA–The Instrumentation, Systems, and Automation Society

Contents

About the Author ..... **ix**

Acknowledgments ..... **xi**

Introduction ..... **xiii**

Chapter 1: What is a Drive? **1**
- Drive Principles of Operation 5
- Types of Drives, Features and Principles 7
- Chapter Review 14
- Check Your Knowledge 14

Chapter 2: Review of Basic Principles **15**
- Introduction 15
- Electrical Principles 15
- Electrical/Electronic Devices 29
- Mechanical Principles 41
- Mechanical Devices 58
- Chapter Review 65
- Check Your Knowledge 67

Chapter 3: AC and DC Motors **69**
- Introduction 69
- DC Motors: General Principles of Operation 69
- AC Motors: General Principles of Operation 90
- Servomotors: General Principles of Operation 122
- Chapter Review 127
- Check Your Knowledge 129

Chapter 4: AC and DC Drives **131**
- Introduction 131
- DC Drives 131
- AC Drives 156
- Chapter Review 201
- Check Your Knowledge 203

Chapter 5: Drive Control and Feedback Devices 205
Open-Loop Control 205
Closed-Loop Control 206
Drive Control Methods: DC 216
Drive Control Methods: AC 219
Sensors and Controls 226
Chapter Review 228
Check Your Knowledge 229

Chapter 6: Drive System Control Methods 231
Introduction 231
Coordinated Drive Systems 231
DC Systems 246
AC Systems 251
AC versus DC Drive Systems 257
Chapter Review 261
Check Your Knowledge 261

Chapter 7: Maintenance and Troubleshooting of Drive Systems..... 263
Routine Drive Maintenance 263
General Troubleshooting 269
Chapter Review 270
Check Your Knowledge 271

Chapter 8: Final Review & Closing Remarks 273
What is a Drive? Why Drives are Applied 273
Review of Basic Principles 273
Motors 275
Drives 276
Drive Control and Feedback Devices 278
Drive Systems 279
Maintenance and Troubleshooting of Drive Systems 280
Closing Remarks 280

Chapter 9: Check Your Knowledge 283

Appendix A: Check Your Knowledge - Answers 287

Appendix B: Formulas and Conversions 301

Appendix C: Drive Enclosure Types 311

Appendix D: Terms and Definitions 315

Bibliography 355

Index 359