

Table of contents provided by Syndetics

- **Preface** (p. ix)
- **Acknowledgments** (p. xi)
- **1 Introduction** (p. 1)
- **1.1 A Personal View** (p. 1)
- **1.2 What Is and Is Not Mechantronics?** (p. 6)
- **2 The Bare Essentials** (p. 9)
- **2.1 Actuators** (p. 9)
- **2.2 Sensors** (p. 16)
- **2.3 Sensors for Vision** (p. 22)
- **2.4 The Computer** (p. 25)
- **2.5 Interface Electronics for Output** (p. 27)
- **2.6 Interface Electronics for Input** (p. 32)
- **2.7 Pragmatic Control** (p. 36)
- **2.8 Robotics and Kinematics** (p. 41)
- **3 Gaining Experience** (p. 43)
- **3.1 Coming to Grips with QBasic** (p. 45)
- **3.2 The Simplest Mobile Robot** (p. 49)
- **3.3 Ball and Beam** (p. 56)
- **3.4 "Professional" Position Control** (p. 64)
- **3.5 An Inverted Pendulum** (p. 80)
- **4 Introduction to the Next Level** (p. 91)
- **4.1 The www.EssMech.com Website** (p. 92)
- **5 Electronic Design** (p. 95)
- **5.1 The Rudiments of Circuit Theory** (p. 95)
- **5.2 The Operational Amplifier** (p. 99)
- **5.3 Filters for Sensors** (p. 103)
- **5.4 Logic and Latches** (p. 113)
- **6 Essential Control Theory** (p. 117)
- **6.1 State Variables** (p. 117)
- **6.2 Simulation** (p. 120)
- **6.3 Solving the First-Order Equation** (p. 121)
- **6.4 Second-Order Problems** (p. 123)
- **6.5 Modeling Position Control** (p. 125)
- **6.6 Matrix State Equations** (p. 127)
- **6.7 Analog Simulation** (p. 128)
- **6.8 More Formal Computer Simulation** (p. 130)
- **7 Vectors, Matrices, and Tensors** (p. 131)
- **7.1 Meet the Matrix** (p. 131)
- **7.2 More on Vectors** (p. 132)
- **7.3 Matrix Multiplication** (p. 134)
- **7.4 Transposition of Matrices** (p. 135)
- **7.5 The Unit Matrix** (p. 136)
- **7.6 Coordinate Transformations** (p. 136)
- **7.7 Matrices, Notation, and Computing** (p. 138)

- **7.8 Eigenvectors** (p. 140)
- **8 Mathematics for Control** (p. 143)
- **8.1 Differential Equations** (p. 143)
- **8.2 The Laplace Transform** (p. 146)
- **8.3 Difference Equations** (p. 150)
- **8.4 The z Transform** (p. 154)
- **8.5 Convolution and Correlation** (p. 157)
- **9 Robotics, Dynamics, and Kinematics** (p. 161)
- **9.1 Gears, Motors, and Mechanisms** (p. 161)
- **9.2 Three-Dimensional Motion** (p. 166)
- **9.3 Kinematic Chains** (p. 173)
- **9.4 Robot Dynamics** (p. 179)
- **9.5 Simulating a Robot** (p. 180)
- **10 Further Control Theory** (p. 185)
- **10.1 Control Topology and Nonlinear Control** (p. 185)
- **10.2 Phase Plane Methods** (p. 192)
- **10.3 Optimization** (p. 199)
- **11 Computer Implementation** (p. 203)
- **11.1 Essentials of Computing** (p. 203)
- **11.2 Software Implications** (p. 206)
- **11.3 Embedded Processors** (p. 210)
- **12 Machine Vision** (p. 221)
- **12.1 Vision Sensors** (p. 221)
- **12.2 Acquiring an Image** (p. 222)
- **12.3 Analyzing an Image** (p. 224)
- **13 Case Studies** (p. 237)
- **13.1 Robocow-a Mobile Robot for Training Horses** (p. 237)
- **13.2 Vision Guidance for Tractors** (p. 243)
- **13.3 A Shape Recognition Example** (p. 251)
- **14 The Human Element** (p. 255)
- **14.1 The User Interface** (p. 255)
- **14.2 If All Else Fails, Read the Instructions** (p. 259)
- **14.3 It Just Takes Imagination** (p. 260)
- **Index** (p. 263)