

- Preface p. xvii
- Introduction p. xix
- Notation Used in This Book p. xxi
- Instrumentation Symbols Used in This Book p. xxiii
- Tag Number System Used in This Book p. xxv
- Chapter 1 Applicability of Miscellaneous Control Strategies--Industrywide p. 1
 - Proportioning or Ratio Control p. 1
 - Other Industries Using Similar Ratioing Techniques p. 2
 - Solid Material Conveying Systems p. 3
 - Other Industries Using Conveyor Techniques p. 5
 - Heat Generation p. 5
 - Furnace Control p. 5
 - Product Quality Control p. 14
 - pH Measurement and Control p. 14
 - Industries That Use pH as a Measurement of Quality p. 16
 - Conductivity Measurement and Control p. 16
 - Industries That Use Conductivity as a Measurement of Quality p. 18
 - Other Industries That Require Control of Parameters Already Discussed p. 18
 - Glass Furnaces p. 18
 - Basic Oxygen Furnaces--Steel Making p. 19
 - Some Considerations on Instrumentation and Control Methods p. 20
 - Instrumentation p. 20
 - Control p. 24
 - Summary p. 29
- Chapter 2 Digesters--Paper Pulp p. 35
 - Control of Continuous Pulp Digesters in Paper Making Pre-Pulping Processes p. 36
 - Processing the Waste from Logging Operations p. 36
 - Preparing the Logs of Wood for Pulping p. 37
 - The Pulping Process p. 39
 - Operating Principles p. 39
 - Mechanical Pulping p. 39
 - Chemical Pulping p. 42
 - Alkaline Pulping p. 42
 - Sulfite Pulping p. 43
 - The Kraft Process p. 44
 - Semicheical and Chemimechanical Processes p. 44
 - A Typical Real Pulping Process p. 45
 - Raw Chip Handling and Pre-Processing p. 46
 - Conveyor Belt Configuration and Material Weighing p. 59
 - Control of the Chip Silo p. 60
 - Control of the Chip Washer p. 61
 - Control of the Chip Hopper p. 62
 - The Low-Pressure Feeder p. 63
 - Control of the Steaming Vessel p. 63
 - Control of the Chip Chute and Level Tank p. 63
 - The High Pressure Feeder p. 64

- Digester Control p. 65
- The Top Separator p. 65
- The Control of the Digester p. 68
- Digester Bottom Scraper p. 72
- Primary Pulp Refining p. 73
- Rotary Vacuum Washer p. 75
- Summary p. 78
- Chapter 3 Paper Machine p. 83
 - The Paper Machine p. 83
 - The Wet End p. 83
 - The Fourdrinier p. 84
 - The Mixing Chest p. 85
 - Stock-Proportioning Ratio Control p. 85
 - Stock-Proportioning Pacing Ratio Control p. 86
 - Pulpers p. 88
 - The Stand-Alone Pulper p. 88
 - The Pulper Located Under the Fourdrinier Machine p. 89
 - Pulp Additives p. 94
 - Sizing p. 95
 - Rosin Size p. 95
 - Latex p. 96
 - Starch p. 96
 - Alum p. 96
 - Fillers p. 97
 - Some of the Fillers Used p. 97
 - Clay p. 97
 - Calcium Sulfate--CaSO₄ p. 97
 - Calcium Carbonate--CaCO₃ p. 98
 - Pulp Preparation Equipment p. 98
 - The Hollander p. 98
 - The Jordan p. 99
 - Disk Refiners p. 103
 - Control of High-Consistency Stuff p. 104
 - Single Dilution of the Stock p. 105
 - Double Dilution of the Stock p. 105
 - The Headbox p. 106
 - Open Type p. 107
 - Control Techniques Used to Ensure an Even Distribution of the Stock p. 107
 - The Headbox Slice p. 108
 - Water Drainage From the Stock on the Wire p. 112
 - Suction Box Vacuum Control p. 113
 - The Wire Pit p. 115
 - The Dry End p. 116
 - Steam Distribution to the Drier Rolls p. 118
 - The Control System for the Drier Roll p. 118
 - The Auto-Selector Control System p. 120

- The Control System for the Drier Rolls--Continued p. 122
- The Yankee Machine p. 123
- Heat Transfer and Drier Performance p. 124
- Instrumentation and Control for the Yankee Drier p. 125
- The Thermo-Compressor p. 128
- Machine Room Ventilation p. 130
- Instrumentation and Control System Operation p. 131
- Ventilation System for a Yankee Drier p. 132
- The Vat or Cylinder Paper Machine p. 133
- Summary p. 136
- Chapter 4 Evaporators p. 147
 - Process Evaporators and Some Techniques to Control Production p. 147
 - Basic Definition of Evaporation p. 147
 - Some Types of Evaporators Used p. 153
 - The Steam Condenser p. 158
 - Control of a Multiple-Effect Evaporator Producing a Milk Concentrate p. 163
 - Raw Milk Receipt p. 163
 - Process Equipment p. 164
 - Raw Milk Handling p. 165
 - The Milk Concentrating Process p. 171
 - Converting the Milk Concentrate to Powdered Milk p. 171
 - The Multiple-Effect Black Liquor Evaporator--For the Paper Industry p. 174
 - The Boiling Point Rise Sensor/Transmitter p. 174
 - Controlling the Multiple-Effect Black Liquor Evaporator Train p. 177
 - The Recovery Boiler for the Paper Industry--Functionality and Control Instrumentation p. 178
 - The Reduction Zone p. 178
 - The Water/Steam Circuit p. 180
 - The Multiple-Effect Evaporator--for the Cane Sugar Industry p. 181
 - System Operation p. 183
 - Summary p. 183
- Chapter 5 Product Distillation p. 187
 - The Basics of the Distillation Process p. 187
 - Laboratory Equipment p. 188
 - Industrial Equipment p. 188
 - The Conversion Process p. 191
 - The Practical Distillation Column p. 193
 - Liquid/Liquid Solutions p. 194
 - Operating a Column in Total Reflux Mode Design of a Distillation Column p. 198
 - Methods of Calculation p. 198
 - Typical Arrangements of Distillation Columns p. 200
 - The Flash Drum p. 200
 - The Absorption and Rectification Columns p. 201
 - Stripping Columns with and without Reboiler p. 202
 - The Azeotropic Distillation Column p. 202
 - Extractive Distillation Column p. 204

- Distillation Column Control Systems p. 204
- Process Heaters--Control of the Inflow of Energy p. 205
- The Dowtherm Heating System p. 205
- Combustion Control of a Direct-Fired Process Heater p. 207
- Indirect Heaters p. 207
- Column Feed Preheat p. 211
- Column Differential Pressure p. 212
- Condensers--Control of the Outflow of Energy p. 212
- Electric Motor Speed Control p. 217
- Example (a) p. 226
- Example (b) p. 226
- Example (c) p. 226
- Starting Up and Shutting Down a Distillation Column p. 238
- Summary p. 241
- Chapter 6 Product Blending p. 259
- In-Line Product Blending p. 259
- Basic Blend-Loop Requirements p. 260
- The Blending System in a Hazardous Environment p. 261
- General Overview of a Microprocessor Based Blending System p. 261
- The Vital Blending Software Blocks p. 266
- Design and Implementation of a (Specific) Blending System p. 276
- System Application--Objectives and Overview, Brief System Specification--Physical Requirements p. 276
- Component Pump Selection p. 280
- The Microprocessor Blending Control Unit p. 285
- Software Design Requirements p. 290
- Communication Between the Blending Controller and the Personal Computer p. 290
- Summary p. 298
- Chapter 7 The Brewing Industry p. 299
- The Raw Materials p. 299
- Barley (and the Malting Process) p. 299
- Water p. 300
- Wheat p. 301
- Oats p. 301
- Millet p. 301
- Corn p. 302
- Yeast and Other Ingredients p. 302
- Yeast p. 302
- Hops p. 302
- Additives p. 302
- The Chemistry p. 303
- Disaccharides p. 303
- Maltose p. 304
- A Brief General Process Overview p. 305
- Beers--Ales and Lagers p. 305
- The Production of Malt p. 305

- Kiln Instrumentation and Control p. 305
- Fuel/Air Ratio Control (Heat Input) p. 307
- Position of the Dampers at the Start of the Malt Finishing Operation p. 308
- Detailed Operation and Terminating the Malting Process p. 309
- Milling p. 310
- The Mashing Operation p. 311
- Grain Weighing p. 311
- Cereal Cooking p. 313
- The Mashing Operation in Practice p. 316
- Lautering p. 319
- The Brew Kettle p. 320
- Fermentation p. 326
- Specific Gravity Measurement p. 328
- Carbon Dioxide Storage p. 330
- Finishing the Fermented Beer p. 331
- Secondary Fermentation p. 331
- Clarification p. 332
- Pasteurization p. 332
- Summary p. 333
- Chapter 8 Project Management and Administration p. 341
- The Technologist Versus the Manager (Administrator) p. 341
- The Manager (Administrator) p. 342
- The Technologist p. 342
- The Requirements of the Administrator p. 342
- Starting off a Project p. 343
- Pre-Project Involvement for the Product Manufacturer p. 345
- The Manufacturing Site p. 345
- Project Justifications p. 346
- Preparation of the Process Plant Specification p. 346
- Selection of the Process Plant Constructor p. 347
- Considerations Given by the Construction Company p. 347
- Technical Aspects p. 347
- Process Engineering Aspects p. 347
- Commercial Aspects p. 348
- Constructor's Invitation to Bid--Issued to Subcontractors p. 349
- The Construction Specification p. 350
- Response of the Instrumentation and Control System Manufacturers p. 351
- The Field Equipment p. 352
- Installation and Commissioning p. 352
- The Control System p. 352
- The Proposal p. 353
- Opening of the Tender Documents From Contractors--by the End User p. 354
- Award of the Contract to the Successful Instrument and System Vendor--by the Contractor p. 354
- The Project Schedule and Administration p. 357
- System Checkout and Final Acceptance Test p. 362

- System Documentation p. 362
- System Packaging and Shipping p. 363
- Close Out Report p. 363
- Some Terms Found in Contractual Documents p. 364
- Summary p. 365
- Bibliography p. 369
- Index p. 371