

Table of Contents

About the Author: Gregory K. McMillan . . .	xiii
Chapter 1.0—Best of the Basics	1
1.1 Introduction	1
1.2 Actions Speak Louder than Words	2
1.3 Controller à la Mode	6
1.4 Is That Your Final Response?	8
1.5 The Key to Happiness	33
1.6 Nothing Ventured, Nothing Gained	38
1.7 Process Control as Taught versus as Practiced	55
Chapter 2.0—Tuning Settings and Methods	57
2.1 First Ask the Operator	57
2.2 Default and Typical Settings	57
2.3 The General-Purpose Closed-Loop Tuning Method	62
2.4 Lambda Self-Regulating Process Tuning Method	69
2.5 Lambda Integrating Process Tuning Method	76
2.6 Tuning for Maximum Absorption of Variability	81

2.7 Window of Allowable Controller Gains . .	83
2.8 Nomenclature and Conversion of Settings for ISA Standard Form.	85
Chapter 3.0—Measurements and Valves	91
3.1 Watch Out for Bad Actors.	91
3.2 Deadly Dead Band.	92
3.3 Sticky Situations	102
3.4 Fouled Sensors.	107
3.5 Noisy Measurements	110
Chapter 4.0—Control Considerations	115
4.1 Auto Tuners.	115
4.2 Uncommonly Good Practices for Common Loops	115
4.3 Dead Time Compensation and Warp Drive	118
4.4 I Have So Much Feedforward, I Eat Before I Am Hungry	122
4.5 Cascade Control Tuning	125
4.6 Keep the Secondary Loop on the Move .	129
Chapter 5.0—Troubleshooting	131
5.1 Patience, Heck, I Need to Solve the Problem	131
5.2 Great Expectations and Practical Limitations	139

Chapter 6.0—Tuning Requirements for	
Various Applications	145
6.1 Batch Control	147
6.2 Blending	150
6.3 Boilers	152
6.4 Coils and Jackets	158
6.5 Compressors	162
6.6 Crystallizers	164
6.7 Distillation Columns	166
6.8 Dryers	169
6.9 Evaporators	171
6.10 Extruders	172
6.11 Fermentors	175
6.12 Heat Exchangers	176
6.13 Neutralizers	178
6.14 Reactors	179
6.15 Remote Cascade	181
6.16 Sheets and Webs	182
Chapter 7.0—Adaptive Control	185
7.1 Learning the Terrain	185
7.2 Watching but not Waiting	186
7.3 Shifting into High Gear	188
7.4 Back to the Future	190
Chapter 8.0—Process Dynamics	193

Chapter 9.0—PID Checklist	207
Conclusion	216
Appendix A—Technical Terms in Process Control that Are Used Interchangeably	217
Appendix B—Basics of PID Controllers	219
Appendix C—Control Loop Performance.	227
Appendix D—Difficult Situations and Different Objectives	245
Index	249