

Contents of Volume 2

Preface to Volume 2	xi
Design Examples	xiii
6. <i>Negative Feedback Amplifiers</i>	211
6.1. Introduction	211
6.2. Feedback Connections	213
6.3. Examples of Series-Parallel Feedback Systems	221
6.3.1. Emitter follower buffer amplifier	221
6.3.2. Output stage for a direct-coupled amplifier	226
6.3.3. Augmented emitter follower	233
6.3.4. Field effect source follower	234
6.3.5. Operational amplifier voltage follower	237
6.3.6. Applications of the voltage follower	241
6.3.7. The voltage follower using operational amplifiers	247
6.3.8. Capacitor-coupled voltage amplifier	251
6.3.9. Selective amplifier using series-parallel feedback	254
6.4. Applications of Parallel-Series Feedback	255
6.4.1. Common base amplifier	255
6.4.2. Transistor current amplifier	256
6.4.3. Operational amplifier current amplifiers	257
6.5. Examples of Parallel-Parallel Feedback	258
6.5.1. Performance of parallel-parallel voltage amplifier	260
6.5.2. Functional operations—integration	262
6.5.3. Difference integrator	268
6.5.4. Double integrator	270
6.5.5. Differentiation	271
6.6. Example of Series-Series Feedback	276
6.7. Instrumentation using Feedback Amplifiers	277
6.7.1. Millivoltmeter	277
6.7.2. Transducer amplifier	278
6.7.3. Difference amplifier	279
6.7.4. Bridge amplifier	281
6.7.5. High-input impedance difference amplifiers	281
6.8. Low-input Resistance Amplifier	283
6.9. Automatic Zeroing	287
6.10. Stabilization against Oscillation	293
6.11. Active Resistor-Capacitor Filters	294
6.11.1. First-order filters	294
6.11.2. Basic second-order filters	296
6.11.3. Resistance-capacitance form of second-order system	298

6.11.4.	Active second-order filter	299
6.11.5.	Higher-order filters	301
6.11.6.	Multiple feedback band-pass filter	302
7.	<i>Power Supplies</i>	305
	Introduction	305
7.1.	The Basic Rectifier	305
7.2.	The Full-wave Rectifier	306
7.3.	Effect of Load Capacitance	306
7.4.	<i>L-C</i> Smoothing Filter	309
7.5.	Choke Input Filter	309
7.6.	Voltage Multipliers	312
7.7.	Voltage Stabilization	313
7.8.	Semiconductor Stabilizer Diodes	315
7.9.	Emitter Follower as a Voltage Stabilizer	317
7.10.	Closed-loop System	319
7.11.	Current Limitation	323
7.12.	Application of Operational Amplifiers as Voltage Regulators	324
7.13.	Fully Integrated Regulators	325
8.	<i>Oscillators</i>	326
	Introduction	326
8.1.	Sinusoidal Oscillators—Basic Considerations	326
8.2.	Negative Resistance	328
8.3.	Amplitude Stabilization	329
8.4.	Survey of Feedback <i>L-C</i> Oscillators	331
8.5.	The Tuned Drain Oscillator	333
8.6.	Colpitts Oscillator using a Bipolar Transistor	337
8.7.	Resistance–Capacitance Oscillators	341
8.8.	Wien Bridge Oscillator	342
8.9.	Closed-loop Level Control	345
8.10.	Frequency Stability	347
8.11.	The Series Resonant Oscillator	348
9.	<i>Waveform Generators</i>	353
	Introduction	353
9.1.	Multivibrators—General Survey of the Three Types	354
9.2.	Transistor Switching	355
9.3.	Speed of Transistor Switching	358
9.4.	Bistable Multivibrator	359
9.5.	Triggering	362
9.6.	Alternative Gating Methods	364
9.7.	Emitter-coupled BMV	364
9.8.	Symmetrical Trigger BMV	367
9.9.	Complementary Bistable Networks	368
9.10.	Integrated Circuit Bistables	369
9.11.	Monostable Multivibrators	374
9.12.	The Direct Coupled MMV	378
9.13.	Asymmetrical MMV	380
9.14.	Integrated Circuit MMV	380
9.15.	Astable Multivibrators	382

CONTENTS OF VOLUME 2

vii

9.16. Emitter-coupled AMV	385
9.17. Complementary AMV	386
9.18. Integrated Circuit AMV	387
9.19. Voltage-controlled AMV	388
9.20. Pulse Generators	390
9.21. Linear Sweep Generators	392
9.22. Use of a Constant-current Generator	393
9.23. Sawtooth Generator using Avalanche Switching	394
9.24. Miller Timebase Generator	397
9.25. Reduction of Recovery Time	400
9.26. Integrated Circuit Waveform Generator/VCO	401
10. <i>Digital Techniques</i>	403
Introduction	403
10.1. Interface Elements	404
10.2. Basic Combinational Logic Elements	405
10.3. Basic Identities for Logic Variables	407
10.4. Example—Data Handling	409
10.5. Exclusive OR	411
10.6. NAND Bistable	412
10.7. Examples	413
10.8. Clocked Bistable	418
10.9. Delta Modulator	419
10.10. Master-Slave JK Bistable	420
10.11. Flip-flop Binary Counters	421
10.12. Decoding	423
10.13. Decade Counter	424
10.14. Counter Applications	425
11. <i>Some General Design Considerations</i>	432
11.1. Resistors	432
11.2. Resistor Types	435
11.3. Capacitors	436
11.4. Capacitor Types	438
11.5. Practical Use of TTL Devices	440
11.6. Screening	442
Appendix C. Symbols used in this Book	xvii
Appendix D. The Thermionic Valve	xxi
Bibliography	xli
Index	xliii

Contents of Volume 1

Preface to Volume 1	xi
Design Examples	xiii
1. <i>The Semiconductor</i>	1
Introduction	1
1.1. The Junction Diode	2
1.2. Leakage Current	3
1.3. Diode Transient Response	4
1.4. Diode Logic	5
1.5. Functional Survey of Diode Types	6
1.6. RF and Microwave Diodes	10
1.7. The Junction Transistor	16
1.8. Fundamental Current Relationships	18
1.9. Elementary Considerations of Frequency Effects	19
1.10. Voltage Breakdown	21
1.11. Power Dissipation	22
1.12. Summary of Transistor Types	23
1.13. Static Characteristics of the Junction Transistor	25
1.14. Small Signal Representation	28
1.15. Transistor Biasing	31
1.16. Transistor Amplifier Characteristics	37
1.17. Examples	46
1.18. Summary of the Characteristics of Transistor Amplifiers in Terms of h Parameters	49
2. SCR-UJT-FET	50
Introduction	50
2.1. The Silicon-controlled Rectifier	50
2.2. Switching Off	53
2.3. Switching Characteristics	55
2.4. Applications	57
2.5. Load Effects	61
2.6. Thyristor Ratings	63
2.7. Gate Characteristic	66
2.8. The Unijunction Transistor	70
2.9. The UJT for Thyristor Triggering	77
2.10. A Bipolar Transistor Analogy	81
2.11. Field Effect Transistors	81
2.12. FET Amplifier Characteristics	88

3. <i>Integrated Circuits</i>	94
Introduction	94
3.1. Manufacturing Processes	94
3.2. Bipolar Integrated Circuits	96
3.3. Digital Logic Families	98
3.4. Noise Immunity	106
3.5. Summary of Bipolar Digital Circuits	108
3.6. Linear Circuits	109
3.7. MOS Integrated Circuits	110
3.8. Complementary MOS	112
3.9. Charge-coupled devices	114
4. <i>Amplifiers</i>	120
Introduction	120
4.1. Power Amplifiers	120
4.2. Audio Power Amplifier, Class A	125
4.3. The Class B Push-pull Amplifier	128
4.4. The Capacitively Coupled Amplifier	131
4.5. High-frequency Performance	132
4.6. High-frequency Response	137
4.7. Asymptotic Approximation	139
4.8. Low-frequency Performance of Capacitively Coupled Stages	140
4.9. Tandem Stages	143
4.10. Amplifier Time Response	151
4.11. Zero Frequency Amplifiers	153
4.12. The Direct-coupled Amplifier	154
4.13. Drift in Transistor d.c. Amplifiers	159
4.14. Integrated Circuit Amplifiers	165
4.15. Operational Amplifier Characteristics	166
4.16. Types and Applications	170
5. <i>Tuned Amplifiers</i>	174
Introduction	174
5.1. The Parallel-tuned Circuit	174
5.2. Single-tuned Circuit Amplifier	174
5.3. Tunable RF Amplifier with Constant Selectivity	175
5.4. Cascaded Single-tuned Amplifier	181
5.5. Staggered-tuned Amplifiers	185
5.6. Double-tuned Circuits	187
5.7. Tuned Amplifiers using Bipolar Transistors	189
5.8. Neutralization	196
5.9. Integrated Circuits	198
	208
Appendix A. Solutions of Simple Network Problems	xvii
Appendix B. Application of the Laplace Transform	xxiii
Appendix C. Symbols used in this Book	xxvii
Bibliography	xxx
Index	xxxiii