Radio-Frequency Electronics
Circuits and Applications

This second, much updated edition of the best-selling Radio-Frequency Electronics introduces the basic concepts and key circuits of radio-frequency systems. It covers the fundamental principles applying to all radio devices, from wireless single-chip data transceivers to high-power broadcast transmitters.

New to this edition:
- Extensively revised and expanded throughout, including new chapters on radar, digital modulation, GPS navigation, and S-parameter circuit analysis.
- New worked examples and end-of-chapter problems aid and test understanding of the topics covered.
- Numerous extra figures provide a visual aid to learning, with over 400 illustrations throughout the book.

Key topics covered include filters, amplifiers, oscillators, modulators, low-noise amplifiers, phase lock loops, transformers, waveguides, and antennas. Assuming no prior knowledge of radio electronics, this is a perfect introduction to the subject. It is an ideal textbook for junior or senior courses in electrical engineering, as well as an invaluable reference for professional engineers in this area.

Praise for the first edition:
This book is wonderfully informative, and refreshingly different from the usual rehash of standard engineering topics. Hagen has put his unique insights, gleaned from a lifetime of engineering and radio science, into this volume and it shows. There’s an insight per page, at least for me, that makes it truly enjoyable reading, even for those of us who think we know something about the field! Paul Horowitz, Harvard University

Jon B. Hagen was awarded his Ph.D. from Cornell University in 1972, where he went on to gain 30 years’ experience as an electronic design engineer, as well as establishing and teaching a Cornell electrical engineering course on RF electronics. Now retired, he has held positions as Principal Engineer at Raytheon, Electronics Department Head at the Arecibo Observatory in Puerto Rico, and Director of the NAIC Support Laboratory at Cornell.
Radio-Frequency Electronics

Circuits and Applications

Second Edition

Jon B. Hagen
# Contents

*Preface*  
* page xiii

1 Introduction  
1.1 RF circuits  
1.2 Narrowband nature of RF signals  
1.3 AC circuit analysis – a brief review  
1.4 Impedance and admittance  
1.5 Series resonance  
1.6 Parallel resonance  
1.7 Nonlinear circuits  
Problems  

2 Impedance matching  
2.1 Transformer matching  
2.2 L-networks  
2.3 Higher $Q$ – pi and T-networks  
2.4 Lower $Q$ – the double L-network  
2.5 Equivalent series and parallel circuits  
2.6 Lossy components and efficiency of matching networks  
Problems  

3 Linear power amplifiers  
3.1 Single-loop amplifier  
3.2 Drive circuitry: common-collector, common-emitter, and common-base  
3.3 Shunt amplifier topology  
3.4 Dual-polarity amplifiers  
3.5 Push–pull amplifiers  
3.6 Efficiency calculations  
3.7 AC amplifiers  


Contents

3.8 RF amplifiers 29
3.9 Matching a power amplifier to its load 31
Problems 31

4 Basic filters 34
4.1 Prototype lowpass filter designs 35
4.2 A lowpass filter example 36
4.3 Lowpass-to-bandpass conversion 38
Appendix 4.1 Component values for normalized lowpass filters 41
Problems 43
References 45

5 Frequency converters 46
5.1 Voltage multiplier as a mixer 46
5.2 Switching mixers 48
5.3 A simple nonlinear device as a mixer 51
Problems 53

6 Amplitude and frequency modulation 54
6.1 Amplitude modulation 55
6.2 Frequency and phase modulation 58
6.3 AM transmitters 62
6.4 FM transmitters 65
6.5 Current broadcasting practice 65
Problems 66

7 Radio receivers 67
7.1 Amplification 67
7.2 Crystal sets 68
7.3 TRF receivers 68
7.4 The superheterodyne receiver 69
7.5 Noise blankers 74
7.6 Digital signal processing in receivers 75
Problems 75
References 76

8 Suppressed-carrier AM and quadrature AM (QAM) 77
8.1 Double-sideband suppressed-carrier AM 77
8.2 Single-sideband AM 78
8.3 Product detector 80
8.4 Generation of SSB 81
8.5 Single-sideband with class C, D, or E amplifiers 83
8.6 Quadrature AM (QAM) 84
Problems 85
References 86

9 Class-C, D, and E Power RF amplifiers 87
9.1 The class-C amplifier 87
9.2 The class-D RF amplifier 92
9.3 The class-E amplifier 94
9.4 Which circuit to use: class-C, class-D, or class-E? 99
Problems 100
References 100

10 Transmission lines 101
10.1 Characteristic impedance 101
10.2 Waves and reflected waves on transmission lines 103
10.3 Modification of an impedance by a transmission line 106
10.4 Transmission line attenuation 107
10.5 Impedance specified by reflection coefficient 107
10.6 Transmission lines used to match impedances 111
Appendix 10.1. Coaxial cable – Electromagnetic analysis 114
Problems 116

11 Oscillators 120
11.1 Negative feedback (relaxation) oscillators 120
11.2 Positive feedback oscillators 121
11.3 Oscillator dynamics 128
11.4 Frequency stability 128
11.5 Colpitts oscillator theory 129
Problems 132

12 Phase lock loops and synthesizers 134
12.1 Phase locking 134
12.2 Frequency synthesizers 144
Problems 150
References 151

13 Coupled-resonator bandpass filters 152
13.1 Impedance inverters 152
13.2 Conversion of series resonators to parallel resonators and vice versa 155
13.3 Worked example: a 1% fractional bandwidth filter 156
13.4 Tubular bandpass filters 158
13.5 Effects of finite Q 160
13.6 Tuning procedures 161
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.7 Other filter types</td>
<td>161</td>
</tr>
<tr>
<td>Problems</td>
<td>162</td>
</tr>
<tr>
<td>References</td>
<td>163</td>
</tr>
<tr>
<td>14 Transformers and baluns</td>
<td>164</td>
</tr>
<tr>
<td>14.1 The “ideal transformer”</td>
<td>165</td>
</tr>
<tr>
<td>14.2 Transformer equivalent circuit</td>
<td>166</td>
</tr>
<tr>
<td>14.3 Power transformer operation</td>
<td>168</td>
</tr>
<tr>
<td>14.4 Mechanical analogue of a perfectly coupled transformer</td>
<td>169</td>
</tr>
<tr>
<td>14.5 Magnetizing inductance used in a transformer-coupled amplifier</td>
<td>170</td>
</tr>
<tr>
<td>14.6 Double-tuned transformer: making use of magnetization and leakage inductances</td>
<td>170</td>
</tr>
<tr>
<td>14.7 Loss in transformers</td>
<td>172</td>
</tr>
<tr>
<td>14.8 Design of iron-core transformers</td>
<td>172</td>
</tr>
<tr>
<td>14.9 Transmission line transformers</td>
<td>175</td>
</tr>
<tr>
<td>14.10 Baluns</td>
<td>176</td>
</tr>
<tr>
<td>Problems</td>
<td>178</td>
</tr>
<tr>
<td>References</td>
<td>180</td>
</tr>
<tr>
<td>15 Hybrid couplers</td>
<td>181</td>
</tr>
<tr>
<td>15.1 Directional coupling</td>
<td>182</td>
</tr>
<tr>
<td>15.2 Transformer hybrid</td>
<td>182</td>
</tr>
<tr>
<td>15.3 Quadrature hybrids</td>
<td>185</td>
</tr>
<tr>
<td>15.4 How to analyze circuits containing hybrids</td>
<td>186</td>
</tr>
<tr>
<td>15.5 Power combining and splitting</td>
<td>187</td>
</tr>
<tr>
<td>15.6 Other hybrids</td>
<td>189</td>
</tr>
<tr>
<td>Problems</td>
<td>192</td>
</tr>
<tr>
<td>Reference</td>
<td>194</td>
</tr>
<tr>
<td>16 Waveguide circuits</td>
<td>195</td>
</tr>
<tr>
<td>16.1 Simple picture of waveguide propagation</td>
<td>195</td>
</tr>
<tr>
<td>16.2 Exact solution: a plane wave interference pattern matches the waveguide boundary conditions</td>
<td>196</td>
</tr>
<tr>
<td>16.3 Waveguide vs. coax for low-loss power transmission</td>
<td>201</td>
</tr>
<tr>
<td>16.4 Waveguide impedance</td>
<td>201</td>
</tr>
<tr>
<td>16.5 Matching in waveguide circuits</td>
<td>202</td>
</tr>
<tr>
<td>16.6 Three-port waveguide junctions</td>
<td>202</td>
</tr>
<tr>
<td>16.7 Four-port waveguide junctions</td>
<td>203</td>
</tr>
<tr>
<td><strong>Appendix 16.1</strong> Lowest loss waveguide vs. lowest loss coaxial line</td>
<td>204</td>
</tr>
<tr>
<td><strong>Appendix 16.2</strong> Coax dimensions for lowest loss, highest power, and highest voltage</td>
<td>206</td>
</tr>
<tr>
<td>Problems</td>
<td>207</td>
</tr>
<tr>
<td>References</td>
<td>207</td>
</tr>
</tbody>
</table>
17 Small-signal RF amplifiers 208
17.1 Linear two-port networks 208
17.2 Amplifier specifications – gain, bandwidth, and impedances 210
17.3 Narrowband amplifier circuits 213
17.4 Wideband amplifier circuits 214
17.5 Transistor equivalent circuits 214
17.6 Amplifier design examples 215
17.7 Amplifier noise 219
17.8 Noise figure 220
17.9 Other noise parameters 222
17.10 Noise figure measurement 223
Problems 223
References 226

18 Demodulators and detectors 227
18.1 AM Detectors 227
18.2 FM demodulators 233
18.3 Power detectors 238
Problems 240
References 241

19 Television systems 242
19.1 The Nipkov system 242
19.2 The NTSC system 243
19.3 Digital television 251
Problems 257
References 258

20 Antennas and radio wave propagation 259
20.1 Electromagnetic waves 259
20.2 Radiation from a current element 261
20.3 Dipole antenna 262
20.4 Antenna directivity and gain 264
20.5 Effective capture area of an antenna 266
20.6 Reflector and horn antennas 267
20.7 Polarization 271
20.8 A spacecraft radio link 272
20.9 Terrestrial radio links 273
20.10 The ionosphere 273
20.11 Other modes of propagation 275
Problems 276
References 277
## Contents

21 Radar 278
- 21.1 Some representative radar systems 278
- 21.2 Radar classification 281
- 21.3 Target characteristics and echo strengths 283
- 21.4 Pulse compression 285
- 21.5 Synthetic aperture radar 286
- 21.6 TR switches 288
- 21.7 Diode switches 291
- 21.8 Radar pulse modulators
  - Problems 297
  - References 298

22 Digital modulation techniques 300
- 22.1 Digital modulators 300
- 22.2 Pulse shaping 303
- 22.3 Root raised-cosine filter 307
- 22.4 8-VSB and GMSK modulation 308
- 22.5 Demodulation 309
- 22.6 Orthogonal frequency-division multiplexing – OFDM 310
- 22.7 Spread-spectrum and CDMA
  - Problems 315
  - Glossary 318
  - References 320

23 Modulation, noise, and information 321
- 23.1 Matched filtering 321
- 23.2 Analysis of a BPSK link 323
- 23.3 On–off keying with envelope detection
  - Problems 335
  - References 335

24 Amplifier and oscillator noise analysis 336
- 24.1 Amplifier noise analysis 336
- 24.2 Oscillator noise 342
- 24.3 Effect of nonlinearity
  - Problems 346
  - References 348

25 The GPS Navigation system 349
- 25.1 System description 349
- 25.2 GPS broadcast format and time encoding 350
- 25.3 GPS satellite transmitter 352
- 25.4 Signal tracking 353
## Contents

25.5 Acquisition 356
25.6 Ionospheric delay 359
25.7 Differential GPS 360
25.8 Augmented GPS 361
25.9 Improvements to GPS 361
25.10 Other satellite navigation systems 362

Problems 362
References 363

### 26 Radio and radar astronomy 364

26.1 Radiometry 365
26.2 Spectrometry 366
26.3 Interferometry 366
26.4 Radar astronomy 368

Problems 374
References 374

### 27 Radio spectrometry 375

27.1 Filters and filterbanks 376
27.2 Autocorrelation spectrometry 376
27.3 Fourier transform spectrometry 381
27.4 I and Q mixing 384
27.5 Acousto-optical spectrometry 385
27.6 Chirp-z spectrometry 386

Problems 388
References 389

### 28 S-parameter circuit analysis 390

28.1 S-parameter definitions 390
28.2 Circuit analysis using S parameters 394
28.3 Stability of an active two-port (amplifier) 397
28.4 Cascaded two-ports 399
28.5 Reciprocity 400
28.6 Lossless networks 400

Problems 404
References 405

### 29 Power supplies 406

29.1 Full-wave rectifier 406
29.2 Half-wave rectifier 408
29.3 Electronically regulated power supplies 409
29.4 Three-phase rectifiers 410
xii Contents

29.5 Switching converters 411
    Problems 419
    References 421

30 RF test equipment 422
30.1 Power measurements 422
30.2 Voltage measurements 423
30.3 Spectrum analysis 424
30.4 Impedance measurements 425
30.5 Noise figure meter 432
    Problems 432
    References 433

Index 434
Preface

This book was written to help the reader to understand, analyze, and design RF circuits. Developed as a textbook for an RF engineering course at Cornell University, it can also be used for self-study and as a reference for practising engineers. The scope of topics is wide and the level of analysis ranges from introductory to advanced. In each chapter, I have tried to convey an intuitive “how things work” understanding from which the mathematical analysis follows. The initial chapters present the amplifiers, filters, modulators, and demodulators, which are the basic building blocks of radio systems, from AM and FM to the latest digital radio systems. Later chapters alternate between systems, such as television, and radio astronomy, and theoretical topics, such as noise analysis and radio spectrometry. The book provides the RF vocabulary that carries over into microwave engineering, and one chapter is devoted to waveguides and other microwave components.

In this second edition, many chapters have been expanded. Others have been rearranged and consolidated. New chapters have been added to cover radar, the GPS navigation system, digital modulation, information transmission, and S-parameter circuit analysis.

The reader is assumed to have a working knowledge of basic engineering mathematics and electronic circuit theory, particularly linear circuit analysis. Many students will have had only one course in electronics, so I have included some fundamental material on amplifier topologies, transformers, and power supplies. The reader is encouraged to augment reading with problem-solving and lab work, making use of mathematical spreadsheet and circuit simulation programs, which are excellent learning aids and confidence builders. Some references are provided for further reading, but whole trails of reference can be found using the internet.

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Jon B. Hagen
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