

CONTENTS

✓ Chapter 1 Network Elements and Models

1.1	Introduction	1
1.2	Classification of networks	1
1.3	Laplace transform	4
1.4	Passive electric network elements	4
1.5	Vacuum-tubes	8
1.6	Junction transistors	12
1.7	Controlled sources	23
1.8	Negative-resistance devices	26

✓ Chapter 2 General Equilibrium Equations

2.1	Introduction	32
2.2	Network topology	32
2.3	The equilibrium equations	41
2.4	Network theorems	51
2.5	State-variable approach	58

✓ Chapter 3 Properties of One-port Networks

3.1	Introduction	77
3.2	Driving-point functions	77
3.3	Stability	82
3.4	Passivity	104

Chapter 4 Two-port Networks

4.1	Introduction	125
4.2	Two-port parameters	125
4.3	External circuit properties of terminated two-port networks	134
4.4	Equivalent circuits for two-port networks	140
4.5	The indefinite admittance matrix for a three-terminal network	147
4.6	External circuit properties of basic vacuum-tube and transistor configurations	154
4.7	Nonlinear distortion	158
4.8	Interconnections of two-port networks	164
4.9	Four special two-port devices	176

Chapter 5 Further Properties of Two-port Networks

5.1	Introduction	197
5.2	Reciprocity	197
5.3	Symmetry	203
5.4	Stability	208
5.5	Potential instability and absolute stability	226
5.6	Passivity	241
5.7	Conjugate-image impedances and maximum power gain	250

Chapter 6 The Scattering Matrix

6.1	Introduction	260
6.2	Scattering relations for a one-port network	260
6.3	The scattering representation of an n -port network	262
6.4	Criterion for passivity of an n -port network	269
6.5	Scattering-impedance relations	270
6.6	Network calculations with scattering parameters	272

Chapter 7 Gain-phase Analysis

7.1	Introduction	282
7.2	Bode diagram	282
7.3	Minimum-phase and non-minimum-phase networks	286
7.4	Some consequences of Cauchy's theorem	289

Chapter 8 Transient Response

8.1	Introduction	308
8.2	Step response of low-pass amplifiers	308
8.3	Forced response to periodic nonsinusoidal excitations	311
8.4	The definition of rise time and delay	317
8.5	Multi-stage amplifiers	324
8.6	Convolution in the time domain	325

Chapter 9 State-variable Approach

9.1	Introduction	336
9.2	Time response	336
9.3	State-transition matrix	338
9.4	A method for computing the approximate time response	342
9.5	Frequency response	346
9.6	Controllability and observability of natural modes	348

Chapter 10 Signal-flow Graphs

10.1	Introduction	358
10.2	The signal-flow graph	358
10.3	The algebra of signal-flow graphs	365

Chapter 11 Feedback Theory

11.1	Introduction	383
11.2	Basic feedback concepts	385
11.3	An algebraic method of evaluating the return difference and null return difference	398
11.4	Properties of feedback	402
11.5	Multiple-loop feedback circuits	414
11.6	Generalized feedback formulae	419

Chapter 12 The Stability Problem in Feedback Amplifiers

12.1	Introduction	439
12.2	Control of natural frequencies	440
12.3	Nyquist stability criterion	450
12.4	A graphical method for evaluating the dominant oscillatory mode from the Nyquist diagram	460
12.5	Criterion of stability for a multiple-loop feedback amplifier	461
12.6	Stabilization techniques	467
— ✓ 12.7	Describing function analysis of nonlinear feedback circuits	480

Chapter 13 Synthesis of *RC* Active Filters

13.1	Introduction	491
13.2	Positive <i>RC</i> –negative <i>RC</i> cascade synthesis	491
13.3	Parallel <i>RC</i> active network synthesis	500
13.4	Positive <i>RC</i> –negative <i>RC</i> driving-point synthesis	503
13.5	Positive <i>RC</i> –positive <i>RL</i> cascade synthesis	513
13.6	Capacitor–gyrator adaptations of <i>LC</i> ladder filters	519

✓ Chapter 14 Distributed *RC* Networks

14.1	Introduction	524
14.2	Uniform distributed <i>RC</i> network	524
14.3	Exponentially tapered distributed <i>RC</i> network	533
14.4	Synthesis using distributed <i>RC</i> networks	538
14.5	Other applications	543

Index	550
-----------------	-----