UNIVERSIDAD NACIONAL DE ENTRE RIOS
FACULTAD DE INGENIERIA
CENTRO DE MEDIOS
BIBLIOTECA
Nº 1 408

Contents

Preface v

PART ONE

Chapter 1. Introduction 1

1-1. Fourier Analysis 1
1-2. The Laplace Transform 2
1-3. Linear Systems 4
1-4. Singularity Functions 5
1-5. The Fourier Transform in Probability Theory 6

Chapter 2. Basic Theorems and Examples 7

2-1. The Fourier Integral 7
2-2. Special Forms of the Fourier Integral 10
2-3. Simple Theorems 14
2-4. Examples 18
2-5. The Convolution Theorem 25
2-6. On the Proof of the Fourier-integral Theorem 29

Chapter 3. Singularity Functions and Line Spectra 35

3-1. Basic Examples 36
3-2. Fourier Series 42
3-3. Poisson's Sum Formula 47
3-4. Periodic-frequency Spectra 49
3-5. Sampling Theorem 50

Chapter 4. Numerical Techniques and Uncertainty Principle . . . 53

4-1. Evaluation of the Fourier Transform 53
4-2. Evaluation of the Inversion Integral 56
4-3. Approximate Evaluation of the Convolution Integral . . . 59
4-4. Duration of a Signal and Uncertainty Principle 62
4-5. Generalization of the Uncertainty Principle 67
Problems 75
Solutions 77

PART TWO

Chapter 5. Linear Systems 81
5-1. Definitions 81
5-2. The System Function. 86
5-3. Evaluation of the Step Response. 89

Chapter 6. Low-pass Filters. 94
6-1. Definitions 94
6-2. Amplitude Distortion. 97
6-3. Causal Systems with Linear Phase 106
6-4. Phase Distortion 108
6-5. Summary 119

Chapter 7. Bandpass Filters 120
7-1. Symmetrical Systems. 120
7-2. Modulated Input 127
7-3. Unsymmetrical Systems 131
7-4. Modulated Input 133
7-5. Group, Phase, and Signal-front Delay 134
7-6. Group, Phase, and Signal-front Velocity 136
7-7. The Principle of Stationary Phase. 139

Chapter 8. Spectrum Analyzers 144
8-1. Simultaneous Spectral Analysis 145
8-2. Sequential Spectral Analysis 150
8-3. Periodic Signals. 153
Problems 161
Solutions 165

PART THREE

Chapter 9. The Laplace Transform 169
9-1. The Unilateral Laplace Transform 169
9-2. Relationship between the Fourier Integral of a Causal Function and the Unilateral Laplace Transform 172
9-3. The Inversion Formula 175
9-4. Evaluation of $f(t)$ 176
9-5. Initial-value Theorem 186
9-6. The Bilateral Laplace Transform. 187

Chapter 10. Integral Theorems 192
10-1. Integral Theorems 192
10-2. Relationship between $R(\omega)$ and $X(\omega)$ 195
10-3. Minimum-phase-shift Functions 204
10-4. Energy of a Signal 212
10-5. Causality Conditions 213
Problems 218
Solutions 220

UNIVERSIDAD NACIONAL DE ENTRE RIOS
FACULTAD DE INGENIERIA
CENTRO DE MEDIOS
BIBLIOTECA

PART FOUR

Chapter 11. Positive Functions and Limit Theorems 223

11-1. The Density Function 223
11-2. Repeated Convolution 226
11-3. The Central-limit Theorem 227
11-4. Error Correction 233

Chapter 12. Generalized Harmonic Analysis, Correlation, and Power Spectra . 240

12-1. Introduction 240
12-2. Finite Energy Signals 241
12-3. Finite Power Signals 245
12-4. Functions with Arbitrary Power Spectra 254
12-5. Generalized Harmonic Analysis 259
Problems 265
Solutions 266

APPENDICES

Appendix I. The Impulse Function as Distribution 269

I-1. Definitions 270
I-2. Generalized Limits 277
I-3. Physical Concepts as Distributions 281

Appendix II. Analytic Functions. 283

II-1. Definitions 283
II-2. Integration 290
II-3. Calculus of Residues 296
II-4. Saddle-point Method of Integration 302
II-5. Positive Real Functions 307

Index 313