Table of Contents

Preface v

Contributors xiii

Ch. 1. Wiener Filtering (with emphasis on frequency-domain approaches) 1
R. J. Bhansali and D. Karavellas

1. Introduction 1
2. Derivation of the filter transfer function and the filter coefficients 2
3. Realization of the Wiener filter in some special cases 7
4. Estimation of the Wiener filter 9
5. Asymptotic properties of the estimated filter coefficients 12
6. A simulation study 15
References 18

Ch. 2. The Finite Fourier Transform of a Stationary Process 21
D. R. Brillinger

1. Introduction 21
2. Central limit theorems 26
3. Direct estimation of second-order spectra 28
4. Linear models 29
5. Parametric models 32
6. Other topics 33
Appendix 35
References 36

Ch. 3. Seasonal and Calendar Adjustment 39
W. S. Cleveland

1. Introduction 39
2. Methods for seasonal adjustment 47

3. Calendar adjustment 55
4. Graphics for seasonal and calendar adjustment 60
5. Spectrum analysis 65
References 70

Ch. 4. Optimal Inference in the Frequency Domain 73
R. B. Davies

1. Introduction 73
2. Theory of asymptotic inference 74
3. Inference in the frequency domain 82
4. Summary and example 89
References 91

Ch. 5. Applications of Spectral Analysis in Econometrics 93
C. W. J. Granger and R. Engle

1. Beginnings 93
2. Applications of the power spectrum 94
3. Application of the cross spectrum 96
4. Evaluation of seasonal adjustment procedures 99
5. Spectral regression 100
6. Frequency-domain factor analysis 103
7. Advanced techniques 104
8. Conclusions 106
References 106

Ch. 6. Signal Estimation 111
E. J. Hannan

1. Introduction 111
2. Regression problems 113
3. Delay estimation 116
Bibliographic Notes 122
References 123

Ch. 7. Complex Demodulation: Some Theory and Applications 125
T. Hasan

1. Introduction 125
2. Basics of complex demodulation 126
3. Statistical properties 132
4. A class of amplitude modulated cosinusoids 148
References 155

Ch. 8. Estimating the Gain of A Linear Filter from Noisy Data 157
M. J. Hinich

Introduction 157
1. Linear filters 157
2. Estimating the phase and gain of the transfer function 158
3. Use of the Hilbert transform 161
4. Numerical approximations 162
5. Estimating the log gain 164
Appendix 166
References 167

Ch. 9. A Spectral Analysis Primer 169
L. H. Koopmans

1. Introduction 169
2. A historical perspective 169
3. The time-series model 171
4. Spectral representations 173
5. The different types of spectra 175
6. Spectra and linear filters 175
7. Spectral parameters for bivariate time series 179
8. Spectra of multidimensional processes 181
References 183

Ch. 10. Robust-Resistant Spectral Analysis 185
R. D. Martin

1. Introduction 185
2. Time-series outliers and nonnormality 187
3. Autoregressive spectral density estimates 196
4. Smoothed periodogram estimates 199
5. Robustness-resistance properties of the spectrum estimate 209
6. An example 212
7. Concluding remarks 217
References 217

Ch. 11. Autoregressive Spectral Estimation 221
E. Parzen

Introduction 221
1. Correlation and spectral functions of a stationary time series 222
2. Filter models of a short-memory stationary time series 225
3. Entropy interpretation of autoregressive spectral densities 228

4. Parametrizations of autoregressive spectral estimators 233
5. Empirical autoregressive spectral estimation 234
6. Autoregressive order determination 238
7. Suggestions for empirical spectral analysis 239
8. A bibliography of autoregressive spectral estimation 242
References 243

Ch. 12. Threshold Autoregression and Some Frequency-Domain Characteristics 249
J. Pemberton and H. Tong

1. Introduction 249
2. Some motivation 250
3. A simplest TAR model 252
4. Some generalisation and some frequency-domain characteristics 255
5. Diagnostic checks of SETAR models from frequency-domain viewpoint 266
References 272

Ch. 13. The Frequency-Domain Approach to the Analysis of Closed-Loop Systems 275
M. B. Priestley

1. Introduction 275
2. Identification of linear systems 276
3. Closed-loop systems: Basic assumptions and notation 278
4. Conditions on the transfer function 280
5. Estimation of the system transfer function (A) 280
6. The case of linear feedback plus noise 286
7. Numerical estimation of the system transfer function and noise structure 287
Summary 290
References 290

Ch. 14. The Bispectral Analysis of Nonlinear Stationary Time Series with Reference to Bilinear Time-Series Models 293
T. Subba Rao

1. Introduction 293
2. Stationary time series and second-order spectral analysis 293
3. Second-order covariance and spectral analysis of linear time-series models 294
4. Bilinear time-series models and second-order spectral analysis 297
5. Volterra series expansion of VBL(p) model 301
6. Spectral and bispectral density functions and their estimation 303
7. Bispectral analysis of the bilinear time-series model BL(1, 0, 1, 1) 308
8. Tests for departure from linearity and Gaussianity 310
Conclusions 318
References 318

Ch. 15. Frequency-Domain Analysis of Multidimensional Time-Series Data 321
E. A. Robinson

1. Introduction 321
2. The wave equation 322
3. Frequency-domain analysis 323
4. The distributed source model in seismic exploration 327
5. Migration of seismic data 330
6. One-dimensional migration 331
7. Two-dimensional migration 335
8. Two-dimensional example 338
9. Concluding remarks 342
References 342

Ch. 16. Review of Various Approaches to Power Spectrum Estimation 343
P. M. Robinson

1. Introduction 343
2. Quadratic spectrum estimators 350
3. Nonquadratic spectrum estimators 356
4. Spectrum estimation from incomplete data 359
References 365

Ch. 17. Cumulants and Cumulant Spectra 369
M. Rosenblatt

Introduction 369
1. Definition 369
2. Spectra 371
3. Spectral estimates 375
4. Nonlinear systems 378
5. Non-Gaussian linear processes and phase information 379
6. Applications 381
References 381

Ch. 18. Replicated Time-Series Regression: An Approach to Signal Estimation and Detection 383
R. H. Shumway

1. Introduction 383
2. Estimation of the regression functions 386
3. Tests of hypotheses in the frequency domain 390
4. Applications to signal detection 396
5. Discussion 405
References 406

Ch. 19. Computer Programming of Spectrum Estimation 409
T. Thrall

1. Introduction 409
2. Two methods of estimation 411
3. Fast Fourier transform (FFT) algorithms 417
4. Tapering and padding the data 419
5. Variance approximations 423
6. Bandwidths and degrees of freedom 425
7. Prefiltering and recoloring 428
8. Trend removal 431
9. Missing values 432
10. Other problems in spectrum estimation and computation 435
References 436

Ch. 20. Likelihood Ratio Tests on Covariance Matrices and Mean Vectors of Complex Multivariate Normal Populations and their Applications in Time Series 439
P. R. Krishnaiah, J. C. Lee and T. C. Chang

1. Introduction 439
2. Complex multivariate normal and complex Wishart distributions 440
3. Distribution of the determinant of the complex multivariate beta matrix 441
4. Test for independence of sets of variates 442
5. Test for sphericity 444
6. Test specifying the covariance matrix 445
7. Test for multiple homogeneity of the covariance matrices 445
8. Simultaneous tests for the homogeneity of populations 447
9. Test specifying the values of the covariance matrix and mean vector 449
10. Applications in time series in the frequency domain 450
Appendix 456
References 475

Subject Index 477

Contents of Previous Volumes 483