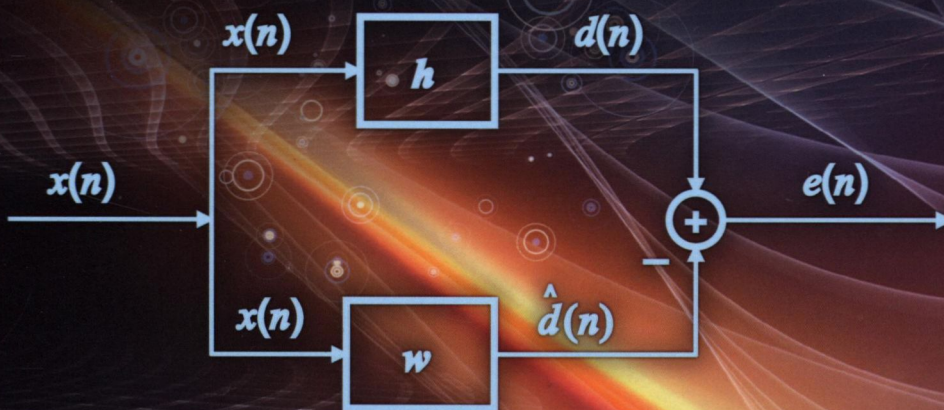
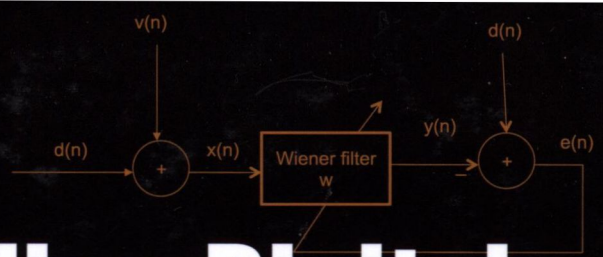
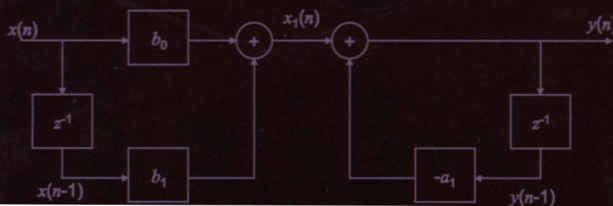


Understanding Digital Signal Processing with MATLAB[®] and Solutions



Alexander D. Poularikas



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Understanding Digital Signal Processing with MATLAB® and Solutions

"Timely and fundamental subject, sparking interest for students and engineers alike. Starts from the basics and builds up the complexity in a logic and very understandable way, so that both beginners and experienced professionals will be able to profit from the book. The book is very useful as a reference, with an extensive set of digital processing operations and clear MATLAB examples and proposed exercises for all of them. The reader can easily find everything related to one specific topic (eg. Fourier transform)."

—Alexandre Giulietti de Barros, Teledyne Anafoocus, Spain

The book discusses receiving signals that most electrical engineers detect and study. The vast majority of signals could never be detected due to random additive signals, known as noise, that distorts them or completely overshadows them. Such examples include an audio signal of the pilot communicating with the ground over the engine noise or a bioengineer listening for a fetus' heartbeat over the mother's. The text presents the methods for extracting the desired signals from the noise. Each new development includes examples and exercises that use MATLAB to provide the answer in graphic forms for the reader's comprehension and understanding.

Features

- Presents an appendix on MATLAB and includes functions developed in the book and those from the software that enables the reader to use MATLAB, even if the reader has no experience in writing programs.
- All the MATLAB functions and programs developed in the book are included both in the text and online for the reader to access and download.
- Includes a large number of examples and drawings explaining every aspect of the subject and elucidating its special parts.
- Although written primarily for the practicing engineer, the text can be used by non-engineers and university students to better understand and use this important area of random digital signal processing.
- Begins with fundamental ideas on probability, random signals, and random vectors and then builds up to more advanced topics, such as non-linear signal processing.

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Abbreviations

ACF	autocorrelation function
ACS	autorrelation sequence
AIC	Akaike information criterion
AR	autoregressive process, $AR(p)$ of order p
ARMA	autoregressive moving average process, $ARMA(p, q)$ of order (p, q)
ARMAX	autoregressive moving average with exogenous source
ARX	autoregressive moving average with exogenous input
BT	Blakman–Tukey
CDF	cumulative distribution function
CRLB	Cramer–Rao lower bound
DFT	discrete Fourier transform
DTFT	discrete-time Fourier transform
ENSS	error normalized step size
FFT	fast Fourier transform of data given by the vector x
FIR	finite impulse response of a discrete system
FPE	final prediction error
FT	Fourier transform
IDFT	inverse discrete Fourier transform
IDTFT	inverse discrete-time Fourier transform
IFFT	inverse fast Fourier transform
IFT	inverse Fourier transform
ID	identically distributed
IID	independent and identically distributed
IIR	infinite impulse response of a discrete system
KVL	Kirchhoff voltage law
LMF	least-mean forth
LMMN	least mean mixed norm
LMS	least mean square
LTl	linear time invariant
LS	least squares
LSE	least-squares error
MA	moving average process, $MA(q)$
MEM	maximum entropy method
MMSE	minimum mean square error
MSE	mean square error
MV	minimum variance
MVUE	minimum variance unbiased estimator
$N(m, v)$	Normal (Gaussian) distribution with mean m and variance v
NLMS	normalized LMS
PDF	probability density function
PNLMS	power normalized LMS
PSD	power spectral density
QAM	quadrature amplitude modulation
ROC	region of convergence
RV	random variable
RVs	random variables
RVSS	robust variable step-size (algorithm)

RW	random walk
SCLMS	self-correcting LMS
SCWF	self-correcting wiener filter
TDLMS	transform domain LMS
VSLMS	variable step-size LMS
WGN	white Gaussian noise
W-K	Wiener-Khintchine
WN	white noise
WSS	wide-sense stationary process
YW	Yule-Walker equations

Author

Alexander D. Poularikas received his PhD from the University of Arkansas and was a professor at the University of Rhode Island. He became chairman of the Engineering Department at the University of Denver and then served as chairman of the Electrical and Computer Engineering Department at the University of Alabama in Huntsville. He has published, co-authored and edited 14 books. Dr. Poularikas served as editor-in-chief of the *Signal Processing Series* (1993–1997) with ARTECH HOUSE and is now editor-in-chief of the *Electrical Engineering and Applied Signal Processing Series* as well as the *Engineering and Science Primers Series* (1998–) with Taylor & Francis Group. He was a Fulbright scholar, is a life-long senior member of IEEE, and a member of Tau Beta Pi, Sigma Nu and Sigma Pi. In 1990 and 1996, he received the Outstanding Educators Award of the IEEE, Huntsville section.

Contents

Abbreviations xiii

Author xv

Chapter 1 Continuous and Discrete Signals 1

1.1 Continuous Deterministic Signals..... 1

 Periodic Signals 1

 Non-Periodic Continuous Signals 1

 Unit Step Functions 2

 Ramp Function 3

 Rectangular Function 3

 Triangular Pulse Function 3

 Signum Function 3

 Sinc Function..... 3

 Gaussian Function 3

 Error Function 3

 Exponential and Double Exponential Functions..... 4

 Type of Signals—Even, Odd, Energy and Power..... 4

1.2 Sampling of Continuous Signals-Discrete Signals..... 6

 Table 1.1: Some Useful Functions in Analog and Discrete Forms..... 7

 Approximation of the Derivative and Integral..... 8

 Impulse (delta) Function..... 9

 Table 1.2: Basic Delta Function Properties 10

 The Comb Function 11

1.3 Signal Conditioning and Manipulation 11

 Modulation 11

 Shifting and Flipping..... 12

 Time Scaling..... 12

 Windowing of Signals 12

 Table 1.3: Windows for Continuous Signal Processing..... 12

1.4 Convolution of Analog and Discrete Signals 13

 Analog Signals 13

 Discrete Signals..... 13

 Table 1.4: Basic Convolution Properties 16

1.5 MATLAB Use for Vectors and Arrays (Matrices)..... 17

 Examples of Array Operations 17

Hints–Suggestions–Solutions of the Exercises 18

Chapter 2 Fourier Analysis of Continuous and Discrete Signals 21

2.1 Introduction 21

2.2 Fourier Transform (FT) of Deterministic Signals..... 21

2.3 Sampling of Signals..... 24

2.4 Discrete-Time Fourier Transform (DTFT)..... 27

2.5 DTFT of Finite-Time Sequences..... 30

 Windowing 32

2.6 The Discrete Fourier Transform (DFT) 33

 The Inverse DFT (IDFT) 34

2.7	Properties of DFT	34
	Linearity.....	34
	Symmetry	34
	Time Shifting.....	35
	Frequency Shifting	35
	Time Convolution.....	35
	Frequency Convolution	37
	Parseval's Theorem.....	37
2.8	Effect of Sampling Time T	37
2.9	Effect of Truncation.....	39
	Windowing	40
2.10	Resolution	40
2.11	Discrete Systems	41
2.12	Digital Simulation of Analog Systems	46
	2.12.1 Second-Order Differential Equations	52
	Hints–Suggestions–Solutions of the Exercises	54
	Appendix 2.1: Fourier Transform Properties	61
	Appendix 2.2: Fourier Transform Pairs.....	62
	Appendix 2.3: DTFT Properties.....	63
	Appendix 2.4: DFT Properties	64
Chapter 3	The z-Transform, Difference Equations, and Discrete Systems.....	65
3.1	The z -Transform.....	65
3.2	Properties of the z -Transform	67
	Table 3.1: Summary of z -Transform Properties	67
3.3	Inverse z -Transform	73
	Table 3.2: Common z -Transform Pairs.....	74
3.4	Transfer Function.....	77
	Higher-Order Transfer Functions	79
3.5	Frequency Response of Discrete Systems	80
3.6	z -Transform Solution of Difference Equations.....	82
	Hints–Suggestions–Solutions of the Exercises	84
Chapter 4	Finite Impulse Response (FIR) Digital Filter Design	89
4.1	Introduction	89
4.2	Finite Impulse Response (FIR) Filters	89
	Discrete Fourier-Series Method	89
	Commonly Used Windows.....	94
	Discrete Fourier Transform Method.....	95
	High-Pass Filter.....	96
	Table 4.1: Frequency Transformations	98
	Hints–Suggestions–Solutions of the Exercises	100
	Appendix 4.1: Window Characteristics and Performance.....	103
Chapter 5	Random Variables, Sequences, and Probability Functions.....	105
5.1	Random Signals and Distributions	105
	Stochastic Processes	110
	Stationary and Ergodic Processes.....	111
5.2	Averages	112

	Mean Value	112
	Correlation.....	113
	Sample Autocorrelation Function.....	113
	Covariance.....	115
	Independent and Uncorrelated RVs.....	116
5.3	Stationary Processes.....	116
	Table 5.1: Properties of WSS Processes	117
	Autocorrelation Matrix.....	117
	Purely Random Process (WN)	118
	Random Walk (RW)	119
5.4	Probability Density Functions.....	119
	Uniform Distribution	119
	Table 5.2: Properties and Definitions	120
	Gaussian (Normal) Distribution	121
	Table 5.3: Properties of a Gaussian Random Process	121
	Exponential Distribution	124
	Lognormal Distribution	126
	Chi-Square Distribution	126
	Student’s Distribution.....	127
	F Distribution	128
	Rayleigh Probability Density Function	128
5.5	Transformations of PDFs.....	130
	Hints, Suggestions, and Solutions for the Exercises	132
Chapter 6	Linear Systems with Random Inputs, Filtering, and Power Spectral Density	137
6.1	Spectral Representation	137
	The Wiener–Khinchine (W–K) Relations	139
6.2	Linear Systems with Random Inputs	142
	Table 6.1: Summary of Correlation and Spectral Densities	143
6.3	Autoregressive Moving Average Processes (ARMA)	149
6.4	Autoregressive (AR) Process.....	151
*6.5	Parametric Representations of Stochastic Processes: ARMA and ARMAX Models	154
	Table 6.2: Linear Systems and Random Signals	154
	Table 6.3: ARMAX Representation	159
	Table 6.4: MA Representation.....	160
	Table 6.5: AR Representation.....	160
	Hints–Suggestions–Solutions for the Exercises	161
Chapter 7	Least Squares-Optimum Filtering.....	167
7.1	Introduction	167
7.2	The Least-Squares Approach	167
7.3	Linear Least Squares	170
	*7.3.1 Matrix Formulation of Linear Least Squares (LLS).....	171
7.4	Point Estimation	172
	7.4.1 Estimator Performance.....	173
	7.4.2 Biased and Unbiased Estimators.....	175
	7.4.3 Cramer–Rao Lower Bound (CRLB)	175
	7.4.4 Mean Square Error Criterion	178
	7.4.5 Maximum Likelihood Estimator.....	178

7.5	Mean Square Error (MSE)	184
7.6	Finite Impulse Response (FIR) Wiener Filter	186
7.7	Wiener Solution—Orthogonal Principle	190
7.7.1	Orthogonality Condition	193
7.8	Wiener Filtering Examples	193
7.8.1	Linear Prediction	204
	Hints, Suggestions, and Solutions of the Exercises	205
Chapter 8	Nonparametric (Classical) Spectra Estimation	211
8.1	Periodogram and Correlogram Spectra Estimation	211
8.1.1	Deterministic Signals (see also Chapter 2)	211
8.1.2	The Periodogram-Random Signals	212
8.1.3	Correlogram	214
8.1.4	Computation of Periodogram and Correlogram Using FFT	215
	Windowed Periodogram	221
8.2	Book Proposed Method for Better Resolution Using Transformation of the Random Variables	222
8.3	Daniel Periodogram	223
8.4	Bartlett Periodogram	224
8.4.1	Book-Modified Method	226
8.5	Blackman–Tukey (BT) Method	229
8.6	Welch Method	233
8.6.1	Proposed Modified Methods for Welch Method	235
	Modified Method Using Different Types of Overlapping	235
	Modified Welch Method Using RV Transformation	238
	Hints, Suggestions, and Solutions of the Exercises	239
	Appendix A8.1: Important Windows and Their Spectra	241
Chapter 9	Parametric and Other Methods for Spectral Estimation	245
9.1	Introduction	245
9.2	AR, MA, and ARMA Models	245
9.3	Yule–Walker (YW) Equations	247
9.4	Least-Squares (LS) Method and Linear Prediction	251
9.5	Minimum Variance Method	254
9.6	Model Order	256
9.7	Levinson–Durbin Algorithm	257
9.8	Maximum Entropy Method	262
9.9	Spectrums of Segmented Signals	263
9.9.1	Method 1: The Average Method	264
9.9.2	Method 2: Extrapolation Method	265
9.10	Eigenvalues and Eigenvectors of Matrices (See Also Appendix 2)	268
9.10.1	Eigendecomposition of the Autocorrelation Matrix	269
	Table 9.1: Eigenvalue Properties	270
9.10.2	Harmonic Model	273
9.10.3	Pisarenko Harmonic Decomposition	277
9.10.4	MUSIC Algorithm	278
	Hints, Suggestions, and Solutions of the Exercises	279