# DIGITAL COMMUNICATIONS

John G. Proakis

THIRD EDITION



MEGRAW-HILL INTERNATIONAL EDITIONS

# **Digital Communication By Proakis 3rd Edition**

**R Barnett** 

#### **Digital Communication By Proakis 3rd Edition:**

Theory and Design of Digital Communication Systems Tri T. Ha,2010-10-28 Providing the underlying principles of digital communication and the design techniques of real world systems this textbook prepares senior undergraduate and graduate students for the engineering practices required in industry Covering the core concepts including modulation demodulation equalization and channel coding it provides step by step mathematical derivations to aid understanding of background material In addition to describing the basic theory the principles of system and subsystem design are introduced enabling students to visualize the intricate connections between subsystems and understand how each aspect of the design supports the overall goal of achieving reliable communications Throughout the book theories are linked to practical applications with over 250 real world examples whilst 370 varied homework problems in three levels of difficulty enhance and extend the text material With this textbook students can understand how digital communication systems operate in the real world learn how to design subsystems and evaluate end to end performance with ease and confidence **Digital Communications** Dr. J. S. Chitode, 2020-12-01 There are eight chapters useful appendix and solved question papers in the book Basic digital communication line codes and sampling methods are presented at the beginning Digital pulse modulation techniques such as PCM DPCM DM ADM are presented Continuous wave digital modulation methods such as BPSK DPSK QPSK QAM BFSK and OOK are presented with mathematical analysis of modulators and receivers Issues related to baseband transmission such as ISI Nyquist pulse shaping criterian optimum reception matched filter and eye patterns are also discussed Concepts of information theory such as discrete memoryless channels mutual information shannon s theorems on source coding are also presented Coding using linear block codes cyclic codes and convolutional coding is also discussed Secured communication using spread spectrum modulation is also discussed in detail Digital Communication Systems Engineering with Software-defined Radio Di Pu, Alexander M. Wyglinski, 2013 For a senior level undergraduate course on digital communications this unique resource provides you with a practical approach to guickly learning the software defined radio concepts you need to know for your work in the field MATLAB/Simulink for Digital Communication Won Y. Yang, 2018-03-02 Chapter 1 Fourier Analysis 1 1 1 CONTINUOUS TIME FOURIER SERIES CTFS 2 1 2 PROPERTIES OF CTFS 6 1 2 1 Time Shifting Property 6 1 2 2 Frequency Shifting Property 6 1 2 3 Modulation Property 6 1 3 CONTINUOUS TIME FOURIER TRANSFORM CTFT 7 1 4 PROPERTIES OF CTFT 13 1 4 1 Linearity 13 1 4 2 Conjugate Symmetry 13 1 4 3 Real Translation Time Shifting and Complex Translation Frequency Shifting 14 1 4 4 Real Convolution and Correlation 14 1 4 5 Complex Convolution Modulation Windowing 14 1 4 6 Duality 17 1 4 7 Parseval Relation Power Theorem 18 1 5 DISCRETE TIME FOURIER TRANSFORM DTFT 18 1 6 DISCRETE TIME FOURIER SERIES DFS DFT 19 1 7 SAMPLING THEOREM 21 1 7 1 Relationship between CTFS and DFS 21 1 7 2 Relationship between CTFT and DTFT 27 1 7 3 Sampling Theorem 27 1 8 POWER ENERGY AND CORRELATION 29 1 9 LOWPASS EQUIVALENT OF BANDPASS SIGNALS 30 Chapter 2 PROBABILITY AND RANDOM PROCESSES 39 2 1 PROBABILITY 39 2 1 1 Definition of Probability 39 2 1 2 Joint Probability and Conditional Probability 40 2 1 3 Probability Distribution Density Function 41 2 1 4 Joint Probability Density Function 41 2 1 5 Condtional Probability Density Function 41 2 1 6 Independence 41 2 1 7 Function of a Random Variable 42 2 1 8 Expectation Covariance and Correlation 43 2 1 9 Conditional Expectation 47 2 1 10 Central Limit Theorem Normal Convergence Theorem 47 2 1 11 Random Processes 49 2 1 12 Stationary Processes and Ergodic Processes 51 2 1 13 Power Spectral Density PSD 53 2 1 14 White Noise and Colored Noise 53 2 2 LINEAR FILTERING OF A RANDOM PROCESS 57 2 3 PSD OF A RANDOM PROCESS 58 2 4 FADING EFFECT OF A MULTIPATH CHANNEL 58 Chapter 3 ANALOG MODULATION 71 3 1 AMPLITUDE MODULATION AM 71 3 1 1 DSB Double Sideband AM Amplitude Modulation 71 3 1 2 Conventional AM Amplitude Modulation 75 3 1 3 SSB Single Sideband AM Amplitude Modulation 78 3 2 ANGLE MODULATION AGM FREQUENCY PHASE MODULATIONS 82 Chapter 4 ANALOG TO DIGITAL CONVERSION 87 4 1 QUANTIZATION 87 4 1 1 Uniform Quantization 88 4 1 2 Non uniform Quantization 89 4 1 3 Non uniform Quantization Considering the Absolute Errors 91 4 2 Pulse Code Modulation PCM 95 4 3 Differential Pulse Code Modulation DPCM 97 4 4 Delta Modulation DM 100 Chapter 5 BASEBAND TRANSMISSION 107 5 1 RECEIVER RCVR and SNR 107 5 1 1 Receiver of RC Filter Type 109 5 1 2 Receiver of Matched Filter Type 110 5 1 3 Signal Correlator 112 5 2 PROBABILITY OF ERROR WITH SIGNALING 114 5 2 1 Antipodal Bipolar Signaling 114 5 2 2 On Off Keying OOK Unipolar Signaling 118 5 2 3 Orthogonal Signaling 119 5 2 4 Signal Constellation Diagram 121 5 2 5 Simulation of Binary Communication 123 5 2 6 Multi Level amplitude PAM Signaling 127 5 2 7 Multi Dimensional Signaling 129 5 2 8 Bi Orthogonal Signaling 133 Chapter 6 BANDLIMITED CHANNEL AND EQUALIZER 139 6 1 BANDLIMITED CHANNEL 139 6 1 1 Nyquist Bandwidth 139 6 1 2 Raised Cosine Frequency Response 141 6 1 3 Partial Respone Signaling Duobinary Signaling 143 6 2 EQUALIZER 148 6 2 1 Zero Forcing Equalizer ZFE 148 6 2 2 MMSE Equalizer MMSEE 151 6 2 3 Adaptive Equalizer ADE 154 6 2 4 Decision Feedback Equalizer DFE 155 Chapter 7 BANDPASS TRANSMISSION 169 7 1 AMPLITUDE SHIFT KEYING ASK 169 7 2 FREQUENCY SHIFT KEYING FSK 178 7 3 PHASE SHIFT KEYING PSK 187 7 4 DIFFERENTIAL PHASE SHIFT KEYING DPSK 190 7 5 QUADRATURE AMPLITUDE MODULATION QAM 195 7 6 COMPARISON OF VARIOUS SIGNALINGS 200 Chapter 8 CARRIER RECOVERY AND SYMBOL SYNCHRONIZATION 227 8 1 INTRODUCTION 227 8 2 PLL PHSE LOCKED LOOP 228 8 3 ESTIMATION OF CARRIER PHASE USING PLL 233 8 4 CARRIER PHASE RECOVERY 235 8 4 1 Carrier Phase Recovery Using a Squaring Loop for BPSK Signals 235 8 4 2 Carrier Phase Recovery Using Costas Loop for PSK Signals 237 8 4 3 Carrier Phase Recovery for QAM Signals 240 8 5 SYMBOL SYNCHRONIZATION TIMING RECOVERY 243 8 5 1 Early Late Gate Timing Recovery for BPSK Signals 243 8 5 2 NDA ELD Synchronizer for PSK Signals 246 Chapter 9 INFORMATION AND CODING 257 9 1 MEASURE OF INFORMATION ENTROPY 257 9 2 SOURCE CODING 259 9 2 1 Huffman Coding 259 9 2 2 Lempel Zip Welch Coding 262 9 2 3 Source Coding vs Channel Coding 265 9 3 CHANNEL MODEL AND CHANNEL CAPACITY 266 9 4 CHANNEL CODING

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codes encoding and syndrome decoding for cyclic codes is also discussed Additional cyclic codes such as RS codes Golav codes burst error correction is also discussed Last chapter presents convolutional codes Time domain transform domain approach code tree code trellis state diagram Viterbi decoding is discussed in detail Communication Systems - II Dr. J. S. Chitode, 2020-12-01 Introduction in first chapter includes various topics given in the book Second chapter deals with information theory that includes modes of sources and channels information and entropy source coding discrete memoryless channels mutual information and Shannon's theorems are given Linear block codes cyclic codes Hamming codes syndrome decoding convolutional codes are given in third chapter Spread spectrum communication includes pseudo noise sequences direct sequence and frequency hop spread spectrum It is presented in fourth chapter Multiple access techniques are reviewed in fifth chapter Sixth chapter deals with satellite communications Satellite orbits satellite access earth station transponder frequency reuse link budget VSAT and MSAT are presented Fibre optic communication is introduced in seventh chapter Light propagation in fiber losses modes dispersion light sources and detectors fiber optic link are presented in this <u>Digital Transmission</u> Dayan Adionel Guimaraes, 2010-01-18 Digital Transmission A Simulation Aided Introduction chapter with VisSim Comm is a book in which basic principles of digital communication mainly pertaining to the physical layer are emphasized Nevertheless these principles can serve as the fundamentals that will help the reader to understand more advanced topics and the associated technology In this book each topic is addressed in two different and complementary ways theoretically and by simulation The theoretical approach encompasses common subjects covering principles of digital transmission like notions of probability and stochastic processes signals and systems baseband and passband signaling signal space representation spread spectrum multi carrier and ultra wideband transmission carrier and symbol timing recovery information theory and error correcting codes The simulation approach revisits the same subjects focusing on the capabilities of the communication system simulation software VisSim Comm on helping the reader to fulfill the gap between the theory and its practical meaning The presentation of the theory is made easier with the help of 357 illustrations A total of 101 simulation files supplied in the accompanying CD support the simulation oriented approach A full evaluation version and a viewer only version of VisSim Comm are also supplied in the CD An Introduction to Digital Communications Jack Kurzweil, 2000 The only book available that integrates a realistic design approach with a theoretical approach This outstanding new book focuses on the central theoretical and practical issues involved in modem design The first half deals with the basic issues of base band and passband data transmission and contains descriptions of applications to specific digital transmission systems The second half specifically addresses design issues including timing and carrier recovery channel characterization adaptive equalization and trellis coding The author uses simulation programs in Matlab and C to help readers Determine the power spectral density of complex data encoding rules Simulate the performance of passband data transmission techniques Design and assess the performance of carrier recovery systems Develop time domain models for a

variety of channels Design and assess the performance of adaptive equalizers. Use existing programs as the framework for creating simulation modules Contemporary Communication Systems Using MATLAB John G. Proakis, Masoud Salehi, 1998 This text contains a large number of MATLAB based problems dealing with topics covered in a first course in communication systems Each chapter contains fundamental concepts briefly reviewed and presents illustration problems using MATLAB Each chapter contains a list of MATLAB files used **Digital Communication Over Fading Channels Marvin K.** Simon, Mohamed-Slim Alouini, 2000-08-14 A unified presentation broad coverage single volume convenience This times aving reference provides a unified approach to the performance analysis of digital communication systems over generalized fading channels Employing alternative forms of such classical mathematical functions as the Gaussian Q function the Marcum Q function and the incomplete Gamma function the book expresses communication system error probability performance in terms of the moment generation function MGF of the fading process This MGF based approach provides the unifying backbone of the book Digital Communication over Fading Channels discusses in detail coherent differentially coherent and noncoherent communication systems as well as a large variety of fading channel models typical of communication links found in the real world Coverage also includes single and multichannel reception and in the case of the latter a large variety of diversity types For each combination of communication type channel fading model and diversity type the average bit error rate and or symbol error rate is expressed in an easy to evaluate form Special features include Important results previously scattered over many publications now in a single volume Simplified results heretofore available only in complex forms Extremely broad coverage of topics Explores practical applications including the problem of optimum combining in the presence of co channel interference Standard Handbook of Electronic Engineering, 5th Edition Donald Christiansen, Charles K. Alexander, Ronald K. Jurgen, 2005-01-10 The Standard Handbook of Electronics Engineering has defined its field for over thirty years Spun off in the 1960 s from Fink s Standard Handbook of Electrical Engineering the Christiansen book has seen its markets grow rapidly as electronic engineering and microelectronics became the growth engine of digital computing The EE market has now undergone another seismic shift away from computing and into communications and media The Handbook will retain much of its evergreen basic material but the key applications sections will now focus upon communications networked media and medicine the eventual destination of the majority of graduating EEs these days Digital Modulation Techniques Fugin Xiong, 2006 This newly revised and expanded edition of an Artech House classic builds on its success as far and away the most comprehensive guide to digital modulation techniques used in communications today The second edition adds a wealth of up to date critical material including Five new chapters devoted to orthogonal frequency division multiplexing OFDM covering its basics and practical implementation issues peak to average power ratio PAPR reduction synchronization fading channel performance and mitigation methods as well as the newest developments such as wavelet OFDM schemes New modulations for optical communications Enhanced coverage of M

ary amplitude shift keying ASK More accurate bit error rate BER equations for quaternary phase shift keying QPSK and quadrature amplitude modulation QAM Enhanced coverage of fading channel mitigation methods such as channel estimate and diversity techniques Fast access comparison of all modulation schemes New appendixes covering trigonometry identities Fourier transform pairs and properties and Q function and error function values **Adaptive Wireless Transceivers** Lajos Hanzo, C. H. Wong, M. S. Yee, 2002-04-03 Adaptive Wireless Transceivers provides the reader with a broad overview of near instantaneously adaptive transceivers in the context of TDMA CDMA and OFDM systems The adaptive transceivers examined employ powerful turbo codecs turbo equalisers and space time codecs equipping the reader with a future proof technological road map It demonstrates that adaptive transceivers are capable of mitigating the channel quality fluctuations of the wireless channel as a lower complexity alternative to space time coding By contrast if the higher complexity of multiple transmitters and multiple receiver assisted systems is deemed acceptable the advantages of adaptability erode Provides an in depth introduction to channel equalisers and Kalman filtering and discusses the associated complexity versus performance trade offs Introduces wideband near instantaneously adaptive transceivers and studies their performance both with and without turbo channel coding Describes how to optimise adaptive modulation mode switching and highlights a range of practical considerations Introduces neural network based channel equalisers and discusses Radial Basis Function RBF assisted equalisers embedded into adaptive modems supported by turbo channel coding and turbo channel equalisation Employs the above adaptive principles also in the context of CDMA and OFDM transceivers and discusses the pros and cons of space time coding versus adaptive modulation Researchers advanced students and practising development engineers working in wireless communications will all find this valuable text an informative read 1996 Fifth IEEE International Conference on Universal Personal Communications Record ,1996 Conference Proceedings ,1999 Oceans '99 MTS/IEEE .1999 **Mobile Fading Channels** Matthias Pätzold, 2002-04 Mobile channel fading is a loss in transmission intensity caused by changes in the transmission medium By dealing with the modelling analysis and simulation of mobile fading channels this text provides a fundamental understanding of many issues in the area of mobile fading channel modelling The main topics addressed in the volume are fundamentals of stochastic and deterministic channel models and modelling and simulation of frequency nonselective and frequency selective fading channels The guide also features methods for the design and realization of efficient channel simulators and fast channel simulators and MATLAB programs for the evaluation and simulation of mobile fading channels Conference Record ,1999

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