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Synchronization is a critical function in digital communications; its failures may have catastrophic effects on the transmission system performance. Furthermore, synchronization circuits comprehend such a large part of the receiver hardware that their implementation has a substantial impact on the overall costs. For these reasons design engineers are particularly concerned with the development of new and more efficient synchronization structures. Unfortunately, the advent of digital VLSI technology has radically affected modem design rules, to a point that most analog techniques employed so far have become totally obsolete. Although digital synchronization methods are well established by now in the literature, they only appear in the form of technical papers, often concentrating on specific performance or implementation issues. As a consequence they are hardly useful to give a unified view of an otherwise seemingly heterogeneous field. It is widely recognized that a fundamental understanding of digital synchronization can only be reached by providing the designer with a solid theoretical framework, or else he will not know where to adjust his methods when he attempts to apply them to new situations. The task of the present book is just to develop such a framework.

Do you need to know how to develop more efficient digital communication systems? Based on the author's experience of over thirty years in industrial design, this practical guide provides detailed coverage of synchronization subsystems and their relationship with other system components. Readers will gain a comprehensive understanding of the techniques needed for the design, performance analysis and implementation of synchronization functions for a range of different modern communication technologies. Specific topics covered include frequency-locked loops in wireless receivers, optimal OFDM timing phase determination and implementation, and interpolation filter design and analysis in digital resamplers. Numerous implementation examples help readers to develop the necessary practical skills, and slides summarizing key concepts accompany the book online. This is an invaluable guide and essential reference for both practicing engineers and graduate students working in digital communications.

Digital Communication Receivers Synchronization, Channel Estimation, and Signal Processing Digital Communication Receivers offers a complete treatment on the theoretical and practical aspects of synchronization and channel estimation from the standpoint of digital signal processing. The focus on these increasingly important topics, the systematic approach to algorithm development, and the linked algorithm-architecture methodology in digital receiver design are unique features of this book. The material is structured according to different classes of transmission channels. In Part C, baseband transmission over wire or optical fiber is addressed. Part D covers passband transmission over satellite or terrestrial wireless channels. Part E deals with transmission over fading channels. Designed for the practicing communication engineer and the graduate student, the book places considerable emphasis on helpful examples, summaries, illustrations, and bibliographies. Contents include: * Basic material * Baseband communications * Passband transmission * Receiver structure for PAM signals * Synthesis of synchronization algorithms * Performance analysis of synchronizers * Bit error degradation caused by random tracking errors * Frequency estimation * Timing adjustment by interpolation * DSP system implementation * Characterization, modeling, and simulation of linear fading channels * Detection and parameter synchronization on fading channels * Receiver structures for fading channels * Parameter synchronization for flat fading channels * Parameter synchronization for selective fading channels

"Timing synchronization plays an important role in recovering the original transmitted signal in telecommunication systems. In order to have a communication system that operates at the correct time and in the correct order, it is necessary to synchronize to the transmitter's symbol timing. Synchronization can be accomplished when the receiver clock tracks the periodic timing information in a transmitted signal to reproduce the original signal. In this thesis work, we report the design, implementation and evaluation of a timing synchronization algorithm based on the technique first proposed by Gardner [1], applied to wireless communication using the Alamouti spacetime code [2] under QPSK modulation with halfsine pulses. To achieve this, a mathematical model is introduced which includes software design of communication algorithms. In this modeling, we simulate the Gardner algorithm in MATLAB. Then, five techniques are introduced to improve the performance of the loop filter in the digital receiver, and they are successfully implemented and evaluated in Matlab. These five techniques prove that there is an improvement in digital receiver performance in terms of the convergence speed and the communication system complexity. On the other hand, the optimum decoding of the Alamouti spacetime code, as initially proposed, makes the nontrivial assumption that the communication system is perfectly synchronized. Realistic wireless environments contain additive white Gaussian noise (AWGN), multipath fading, and it is not perfectly synchronized. In this thesis, the Alamouti spacetime code technique is written for QPSK modulation scheme to work in realistic environment that involves a timing synchronization technique. We compare the bit error rate (BER) of the Alamouti decoder when synchronized using the proposed algorithms with the ideal results found in the literature, and we find them to be similar, proving that the synchronization algorithm is in fact achieving optimum synchronization. This thesis presents synchronization algorithms that are necessary for a complete working wireless Alamouti technique. Also, this thesis improves the communication system performance in terms of the convergence speed with reducing the computational complexity of the communication system design"--Abstract.

Based on the popular Artech House classic, Digital Communication Systems Engineering with Software-Defined Radio, this book provides a practical approach to quickly learning the software-defined radio (SDR) concepts needed for work in the field. This up-to-date volume guides readers on how to quickly prototype wireless designs using SDR for real-world testing and experimentation. This book explores advanced wireless communication techniques such as OFDM, LTE, WLA, and hardware targeting. Readers will gain an understanding of the core concepts behind wireless hardware, such as the radio frequency front-end, analog-to-digital and digital-to-analog converters, as well as various processing technologies. Moreover, this volume includes chapters on timing estimation, matched filtering, frame synchronization message decoding, and source coding. The orthogonal frequency division multiplexing is explained and details about HDL code generation and deployment are provided. The book concludes with coverage of the WLAN toolbox with OFDM beacon reception and the LTE toolbox with downlink reception. Multiple case studies are provided throughout the book. Both MATLAB and Simulink source code are included to assist readers with their projects in the field.

Discusses long-term developments Addresses advanced physical layer techniques designed for broadband communications, for fixed and mobile terminals Considers 4G evolutions and possible convergence between different technologies

This volume presents the logical arithmetical or computational procedures within communications systems that will ensure the solution to various problems. The authors comprehensively introduce the theoretical elements that are at the basis of the field of algorithms for communications systems. Various applications of these algorithms are then illustrated with particular attention to wired and wireless network access technologies. * Provides a complete treatment of algorithms for communications systems, rarely presented together * Introduces the theoretical background to digital communications and signal processing * Features numerous applications including advanced wireless modems and echo cancellation techniques * Includes useful reference lists at the end of each chapter Graduate students in the fields of Telecommunications and Electrical Engineering Researchers and Professionals in the area of Digital Communications, Signal Processing and Computer Engineering will find this book invaluable.

"Professor Andreas F. Molisch, renowned researcher and educator, has put together the comprehensive book, Wireless Communications. The second edition, which includes a wealth of new material on important topics, ensures the role of the text as the key resource for every student, researcher, and practitioner in the field." —Professor Moe Win, MIT, USA Wireless communications has grown rapidly over the past decade from a niche market into one of the most important, fast moving industries. Fully updated to incorporate the latest research and developments, Wireless Communications, Second Edition provides an authoritative overview of the principles and applications of mobile communication technology. The author provides an in-depth analysis of current treatment of the area, addressing both the traditional elements, such as Rayleigh fading, BER in flat fading channels, and more recently emerging topics such as multi-user detection in CDMA systems, MIMO systems, and cognitive radio. The dominant wireless standards, including cellular, cordless and wireless LANs, are discussed. Topics featured include: wireless propagation channels, transceivers and signal processing, multiple access and advanced transceiver schemes, and standardised wireless systems. Combines mathematical descriptions with intuitive explanations of the physical facts, enabling readers to acquire a deep understanding of the subject. Includes new chapters on cognitive radio, cooperative communications and relaying, video coding, 3GPP Long Term Evolution, and WiMax, plus significant new sections on multi-user MIMO, 802.11n, and information theory. Companion website featuring: supplementary material on 'DECT', solutions manual and presentation slides for instructors, appendices, list of abbreviations and other useful resources.

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