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Multi-Carrier Digital Communications *PAPR Reduction Techniques for OFDM Signals* **Improvement of Papr Reduction for Ofdm Signal in Lte System A Study on the Tone-Reservation Technique for Peak-to-Average Power Ratio Reduction in OFDM Systems The Orthogonal Frequency Division Multiplexing (OFDM). Introduction and explanation of five different types of techniques Indoor Positioning System Using Software Defined Radio (SDR) and Support Vector Machine (SVM) Through Use of Orthogonal Frequency Division Multiplexing (OFDM) Signals** Orthogonal Frequency Division Multiplexing for Wireless Communications Synchronization Analysis and Simulation of a Standard IEEE 802. 11G OFDM Signal **OFDM Systems for Wireless Communications OFDM Wireless OFDM Systems Effects of Cyclic Prefix Jamming Versus Noise Jamming in OFDM Signals Peak to Average Power Ration Reduction and Bit Error Rate Improvement in Wireless Orthogonal Frequency Division Multiplexing**

Communication Systems MIMO OFDM Radar-Communication System with Mutual Interference Cancellation *Orthogonal Frequency-division Multiplexing for Optical Communications* **A Detailed Study of 4G in Wireless Communication: Looking Insight in Issues in OFDM Detection of OFDM Signals in Fast Time-Varying Channels** Modulation in Electronics and Telecommunications **On Detection of OFDM Signals for Cognitive Radio Applications** Time Offset Estimation for OFDM Signals **Reduction of the Peak to Average Power Ratio of Orthogonal Frequency Division Multiplexing Signals Using the Clipping Technique Physical Layer Algorithms For Interference Reduction In Ofdm-Based Cognitive Radio Systems Equalization of OFDM Signals Using Pilot Carriers Synchronization of OFDM Signals in MIMO Systems Blind Equalization and Fading Channel Signal Recovery of OFDM Modulation** *Digital Signal Processing for High-Speed Optical Communication Improved Blind Detection of OFDM Signals* **Frequency Estimation for Single Carrier and OFDM Signals in Communication and Radar Systems** Performance Analysis of a Multi-user Detector for OFDM Signals Based on Successive Cancellation **Optical Fiber Telecommunications VIB** *Peak-to-Average Power Ratio Reduction in Ofdm Systems* **Effects of Multipath and Oversampling on Navigation Using Orthogonal Frequency Division Multiplexed Signals of Opportunity** Peak-to-average Power Ratio Reduction of OFDM Signals Using Pulse

Shaping Techniques **Peak to Average Power Ratio Control of OFDM Signals with Time Interleaved Complementary Code Phase Modulation Reducing PAPR of OFDM Signals Using Partial Transmit Sequences** *Blind Detection with Normalized Amplitudes for OFDM Signals Generation, Detection and Processing of Terahertz Signals* **Block Transceivers Identification and Classification of OFDM Based Signals Using Preamble Correlation and Cyclostationary Feature Extraction Localization with OFDM Signals in 5G Systems**

This book contains detailed descriptions and associated discussions regarding different generation, detection and signal processing techniques for the electrical and optical signals within the THz frequency spectrum (0.3–10 THz). It includes detailed reviews of some recently developed electronic and photonic devices for generating and detecting THz waves, potential materials for implementing THz passive circuits, some newly developed systems and methods associated with THz wireless communication, THz antennas and some cutting-edge techniques associated with the THz signal and image processing. The book especially focuses on the recent advancements and several research issues related to THz sources, detectors and THz signal and image processing techniques; it also discusses theoretical, experimental, established and validated empirical works on these topics. The book caters to a very wide range of readers from basic science to technological experts as well as students. The drive towards higher spectral efficiency and maximum power efficiency in optical systems has generated renewed interest in the optimization of optical transceivers. In this work, we study the different optical applications: Wide Area Networks (WANs), Metropolitan Area Networks (MANs), Local Area Networks (LANs) and Personal Area Networks (PANs). In WANs or long-haul systems, orthogonal frequency-division multiplexing (OFDM) can compensate for linear distortions, such as group-velocity dispersion (GVD) and polarization-mode dispersion (PMD), provided the cyclic prefix is sufficiently long. Typically, GVD is dominant, as it requires a longer cyclic prefix. Assuming coherent detection, we show how to analytically compute the minimum number of subcarriers and cyclic prefix length required to achieve a specified power penalty, trading off power penalties from the cyclic prefix and from residual inter-symbol interference (ISI) and inter-carrier interference (ICI). We derive an analytical expression for the power penalty from residual ISI and ICI. We also show that when nonlinear effects are present in the fiber, single-carrier with digital equalization outperforms OFDM for various dispersion maps. We also study the impairments of electrical to optical conversion when using Mach-Zehnder (MZ) modulators. OFDM has a high peak-to-average ratio (PAR), which can result in low optical power efficiency when modulated through a Mach-Zehnder (MZ) modulator. In addition, the nonlinear characteristic of the MZ can cause significant distortion on the OFDM signal, leading to in-band intermodulation products between subcarriers. We show that a quadrature MZ with digital pre-distortion and hard clipping is able to overcome the previous impairments. We consider quantization noise and compute the minimum number of bits required in the digital-to-analog converter (D/A). Finally, we discuss a dual-drive MZ as a simpler alternative for the OFDM modulator, but our results show that it requires a higher oversampling ratio to achieve the same performance as the quadrature MZ. In MANs, we discuss the use OFDM for combating GVD effects in amplified direct-detection (DD) systems using single-mode fiber. We review known direct-detection OFDM techniques, including asymmetrically clipped optical OFDM (ACO-OFDM), DC-clipped OFDM (DC-OFDM) and single-sideband OFDM (SSB-OFDM), and derive a linearized channel model for each technique. We present an iterative procedure to achieve optimum power allocation for each OFDM technique, since there is no closed-form solution for amplified DD systems. For each technique, we minimize the optical power required to transmit at a given bit rate and normalized GVD by iteratively adjusting the bias and optimizing the power allocation among the subcarriers. We verify that SSB-OFDM has the best optical power efficiency among the different OFDM techniques. We compare these OFDM techniques to on-off keying (OOK) with maximum-likelihood sequence detection (MLSD) and show that SSB-OFDM can achieve the same optical power efficiency as OOK with MLSD, but at the cost of requiring twice the electrical bandwidth and also a complex quadrature modulator. We compare the computational complexity of the different techniques and show that SSB-OFDM requires fewer operations per bit than OOK with MLSD. In LANs, we compare the performance of several OFDM schemes to that of OOK in combating modal dispersion in multimode fiber links. We review known OFDM techniques using intensity modulation with direct detection (IM/DD), including DC-OFDM, ACO-OFDM and pulse-amplitude modulated discrete multitone (PAM-DMT). We describe an iterative procedure to achieve optimal power allocation for DC-OFDM, and compare analytically the performance of ACO-OFDM and PAM-DMT. We also consider unipolar M-ary pulse-amplitude modulation (M-PAM) with minimum mean-square error decision-feedback equalization (MMSE-DFE). For each technique, we quantify the optical power required to transmit at a given bit rate in a variety of multimode fibers. For a given symbol rate, we find that unipolar M-PAM with MMSE-DFE has a better power performance than all OFDM formats. Furthermore, we observe that the difference in performance between M-PAM and OFDM increases as the spectral efficiency increases. We also find that at a spectral efficiency of 1 bit/symbol, OOK performs better than ACO-OFDM using a symbol rate twice that of OOK. At higher spectral efficiencies, M-PAM performs only slightly better than ACO-OFDM using twice the symbol rate, but requires less electrical bandwidth and can employ analog-to-digital converters at a speed only 81% of that required for ACO-OFDM. In PANs, we evaluate the performance of the three IM/DD OFDM schemes in combating multipath distortion in indoor optical wireless links, comparing them to unipolar M-PAM with MMSE-DFE. For each modulation method, we quantify the received electrical SNR required at a given bit rate on a given channel, considering an ensemble of 170 indoor wireless channels. When using the same symbol rate for all modulation methods, M-PAM with MMSE-DFE has better performance than any OFDM format over a range of spectral efficiencies, with the advantage of M-PAM increasing at high spectral efficiency. ACO-OFDM and PAM-DMT have practically identical performance at any spectral efficiency. They are the best OFDM formats at low spectral efficiency, whereas DC-OFDM is best at high spectral efficiency. When ACO-OFDM or PAM-DMT are allowed to use twice the symbol rate of M-PAM, these OFDM formats have better performance than M-PAM. When channel state information is unavailable at the transmitter, however, M-PAM significantly outperforms all OFDM formats. When using the same symbol rate for all modulation methods, M-PAM requires approximately three times more computational complexity per processor than all OFDM formats and 63% faster analog-to-digital converters, assuming oversampling ratios of 1.23 and 2 for ACO-OFDM and M-PAM, respectively. When OFDM uses twice the symbol rate of M-PAM, OFDM requires 23% faster analog-to-digital converters than M-PAM but OFDM requires approximately 40% less computational complexity than M-PAM per processor. Algorithms for blind equalization and data recovery of orthogonal frequency-division multiplexed (OFDM) signals transmitted through fading channels are implemented and simulated in this thesis. The channel is estimated without knowledge of the transmitted sequence (i.e., blindly) using a least mean squares (LMS) adaptive filter and filter bank precoders. This method was used to estimate channel characteristics using both binary and quadrature phase-shift keying signals. Additionally, the method was analyzed for robustness with a poor initial estimate of channel characteristics, with the addition of white Gaussian noise to the signal, and with non-stationary channel conditions. In addition, it is shown that the proposed method is particularly suited in situations with deep fading channels, where some of the subcarriers have a very low SNR. Simulations for both aspects of this thesis were conducted using MATLAB, and the results are presented. The demand for data traffic over mobile communication networks has substantially increased during the last decade. As a result, these mobile broadband devices spend the available spectrum fiercely, requiring the search for new technologies. In transmissions where the channel presents a frequency-selective behavior, multicarrier modulation (MCM) schemes have proven to be more efficient, in terms of spectral usage, than conventional modulations and spread spectrum techniques. The orthogonal frequency-division multiplexing (OFDM) is the most popular MCM method, since it not only increases spectral efficiency but also yields simple transceivers. All OFDM-based systems, including the single-carrier with frequency-division equalization (SC-FD), transmit redundancy in order to cope with the problem of interference among symbols. This book presents OFDM-inspired systems that are able to, at most, halve the amount of redundancy used by OFDM systems while keeping the computational complexity comparable. Such systems, herein called memoryless linear time-invariant (LTI) transceivers with reduced redundancy, require low-complexity arithmetical operations and fast algorithms. In addition, whenever the block transmitter and receiver have memory and/or are linear time-varying (LTV), it is possible to reduce the redundancy in the transmission even further, as also discussed in this book. For the transceivers with memory it is possible to eliminate the redundancy at the cost of making the channel equalization more difficult. Moreover, when time-varying block transceivers are also employed, then the amount of redundancy can be as low as a single symbol per block, regardless of the size of the channel memory. With the techniques presented in the book it is possible to address what lies beyond the use of OFDM-related solutions in broadband transmissions. Table of Contents: The Big Picture / Transmultiplexers / OFDM / Memoryless LTI Transceivers with Reduced Redundancy / FIR LTV Transceivers with Reduced Redundancy The book presents new results of research advancing the field and applications of modulation. The information contained herein is important for improving the performance of modern and future wireless communication systems (CS) and networks. Chapters cover such topics as amplitude modulation, orthogonal frequency-division multiplexing (OFDM) signals, electro-optic lithium niobate (LiNbO3) modulators for optical communications, radio frequency signals, and more. Orthogonal Frequency Division Multiplexing (OFDM), a multicarrier modulation technique, widely used for many of the latest wireless standards such as Wi-Fi, LTE / LTE-A, DAB, DVB, WiMAX and so on. However, its high peak-to-average power ratio (PAPR) for a large number of subcarriers which may drive the amplifier into non-linear region that radiates signals out of band, making it unobtrusive for practical applications. In this book, the comprehensive research and comparison are put forward for a variety of currently promising PAPR reduction methods on the basis of extensive reading and studying of associated papers and literature in this research area. The book caters to the needs of research fraternity and students in the field of wireless communication. The requirement for the readers of this book is to be familiar with the basics of OFDM system, however, R & D engineers from industry community working under wireless communication group can also benefit from this book as a supplementary reference. Thesis (M.A.) from the year 2019 in the subject Electrotechnology, grade: 9, , language: English, abstract: The Orthogonal Frequency Division Multiplexing (OFDM) is an important aspect of multicarrier digital data transmission system where a single data stream is transmitted into a several number of lower rates subcarrier signals. In this thesis, there are five different types of the techniques introduced to strengthen the communication quality and capacity. This kind of new standard of transmission of data is the first one to perform with OFDM in data packet based communication system. In wireless communication network, the abstraction of parallel transmission of data symbols is implemented to attain high throughput and effective transmission quality. The OFDM is a method to deal with parallel transmission. Orthogonal

Frequency Division Multiplexing (OFDM) systems are widely used in the standards for digital audio/video broadcasting, WiFi and WiMax. Being a frequency-domain approach to communications, OFDM has important advantages in dealing with the frequency-selective nature of high data rate wireless communication channels. As the needs for operating with higher data rates become more pressing, OFDM systems have emerged as an effective physical-layer solution. This short monograph is intended as a tutorial which highlights the deleterious aspects of the wireless channel and presents why OFDM is a good choice as a modulation that can transmit at high data rates. The system-level approach we shall pursue will also point out the disadvantages of OFDM systems especially in the context of peak to average ratio, and carrier frequency synchronization. Finally, simulation of OFDM systems will be given due prominence. Simple MATLAB programs are provided for bit error rate simulation using a discrete-time OFDM representation. Software is also provided to simulate the effects of inter-block-interference, inter-carrier-interference and signal clipping on the error rate performance. Different components of the OFDM system are described, and detailed implementation notes are provided for the programs. The program can be downloaded here. Table of Contents: Introduction / Modeling Wireless Channels / Baseband OFDM System / Carrier Frequency Offset / Peak to Average Power Ratio / Simulation of the Performance of OFDM Systems / Conclusions From the reviews: "This book [...] gives a comprehensive overview of the implementation of OFDM systems. [...] For those who study or work on broadband communication in a wireless multipath environment, this book is a useful and easy-to-read reference. […]" (Zongsen Wu, Shaowen Song and Tianying Ji, Physics and Computing Dept., Wilfrid Laurier University, ON) Orthogonal Frequency Division Multiplexing (OFDM) is a multi-carrier transmission scheme used in most of the existing wireless standards such as LTE, WiFi and WiMAX. The popularity of OFDM stems from the multitude of benefits it offers in terms of providing high data rate transmission, robustness against multipath fading and ease of implementation. Additionally, OFDM signals are agile in the sense that any subcarrier can be switched on or off to fit the available transmission bandwidth, which makes it well suited for systems with dynamic spectrum access such as cognitive radio systems. Nonetheless, and despite all the aforementioned advantages, OFDM signals have high spectral sidelobes outside the designated band of transmission, that can create severe interference to users in adjacent transmission bands, particularly when there is no synchronization between users. The focus of this dissertation is to propose baseband solutions at the Physical Layer (PHY) of the communications system to address the interference resulting from the high out-of-band (OOB) emissions of OFDM. In the first part of this dissertation, we propose a precoder capable of generating mask compliant OFDM signals with low OOB emissions that are always contained under a given spectrum emission mask (SEM) specified by the OFDM standard. The proposed precoder generates transmitted signals with bit error rate (BER) performance similar to that of classical OFDM and does not reduce the spectral efficiency of the system. In the second part of this dissertation, we introduce a novel and elegant approach, called suppressing alignment (SA), to jointly reduce the OOB interference and peak-to-average power ratio (PAPR) of OFDM systems. SA exploits the unavoidable redundancy provided by the CP as well as the wireless communications channel to generate an OOB/PAPR suppressing signal at the OFDM transmitter. As a promising technique, OFDM has been widely used in emerging broadband communication systems, such as digital audio broadcasting (DAB), high-definition television (HDTV), and wireless local area network (IEEE 802.11a and HIPERLAN/2). However, as the OFDM signals are the sum of signals with random amplitude and phase, they are likely to have large PAPR that require a linear high-power-amplifier (HPA) with an extremely high dynamic range which is expensive and inefficient. Furthermore, any amplifier nonlinearity causes intermodulation products resulting in unwanted out-of-band power. A number of approaches have been proposed to deal with the PAPR problem, including amongst others, clipping, clipping-and-filtering (CF), coding, companding transform, active constellation extension (ACE), selected mapping (SLM), and partial transmit sequence (PTS). This book proposes an improvement in the selected mapping technique. The resulting scheme can also be applied to the multiple transmitting antenna cases. Further, it compares the simulation results to the existing techniques namely exponential companding transform, repeated clipping and filtering, and adaptive active constellation extension. (Preliminary): The

Orthogonal Frequency Division Multiplexing (OFDM) digital transmission technique has several advantages in broadcast and mobile communications applications. The main objective of this book is to give a good insight into these efforts, and provide the reader with a comprehensive overview of the scientific progress which was achieved in the last decade. Besides topics of the physical layer, such as coding, modulation and non-linearities, a special emphasis is put on system aspects and concepts, in particular regarding cellular networks and using multiple antenna techniques. The work extensively addresses challenges of link adaptation, adaptive resource allocation and interference mitigation in such systems. Moreover, the domain of cross-layer design, i.e. the combination of physical layer aspects and issues of higher layers, are considered in detail. These results will facilitate and stimulate further innovation and development in the design of modern communication systems, based on the powerful OFDM transmission technique. Multi-carrier modulation, in particular orthogonal frequency division multiplexing (OFDM), has been successfully applied to a wide variety of digital communications applications for several years. Although OFDM has been chosen as the physical layer standard for a diversity of important systems, the theory, algorithms, and implementation techniques remain subjects of current interest. This book is intended to be a concise summary of the present state of the art of the theory and practice of OFDM technology. This book offers a unified presentation of OFDM theory and high speed and wireless applications. In particular, ADSL, wireless LAN, and digital broadcasting technologies are explained. It is hoped that this book will prove valuable both to developers of such systems, and to researchers and graduate students involved in analysis of digital communications, and will remain a valuable summary of the technology, providing an understanding of new advances as well as the present core technology. Orthogonal Frequency Division Multiplexing for Wireless Communications is an edited volume with contributions by leading authorities in the subject of OFDM. Its coverage consists of principles, important wireless topics (e.g. Synchronization, channel estimation, etc.) and techniques. Included is information for advancing wireless communication in a multipath environment with an emphasis on implementation of OFDM in base stations. Orthogonal Frequency Division Multiplexing for Wireless Communications provides a comprehensive introduction of the theory and practice of OFDM. Chapter 1, by G. Stüber, briefly introduces the history of OFDM or multicarrier modulation and basic concepts of OFDM, Chapter 2, by Y. (G.) Li, presents design of OFDM systems for wireless communications, various impairments caused by wireless channels, and some other types of OFDM related modulation. Chapter 3 to Chapter 6 address different techniques to mitigate the impairments and to improve the performance of OFDM systems. Chapter 3, by J. Cioffi and L. Hoo, focuses on system optimization techniques, including channel partitioning, loading of parallel channels, and optimization through coding. Chapter 4, by S. Wilson and P. Ödling, addresses timing- and frequency-offset estimation in OFDM systems. It also briefly discusses sampling clock offset estimation and correction. Chapter 5, by Y. (G.) Li, deals with pilot aided and decision-directed channel estimation for OFDM systems. Chapter 6, by C. Tellambura and M. Friese, discusses various techniques to reduce the peak-to-average power ratio of OFDM signals. To facilitate the readers, extensive subject indices and references are given at the end of the book. Even though each chapter is written by different experts, symbols and notations in all chapters of the book are consistent. Synchronization of orthogonal frequency-division multiplexed (OFDM) signals is significantly more difficult than synchronization of a single-carrier system. The recently approved IEEE Standard 802,1 ig specifies a packet-based OFDM system that provides a basis for the discussion of OFDM synchronization in a packet-based enviwnment. Algorithms that synchronize the receiver can'ier demodulation frequency and phase, the data flame, the OFDM symbol timing, and the data symbol timing are discussed and analyzed in an AWGN channel. System View simulation is used to implement the flame and carrier frequency synchronization algorithms, where the perton%ance of these algon'thms is analyzed and they are shown to be useful detection algorithms for Standard 802.1 ig sig- nal reception. In the last couple of years, wireless communications have experienced a quick growth due to the ubiquitous mobility, super internet speed and huge multimedia services & applications. Orthogonal frequency division multiplexing (OFDM) is an emerging research field of wireless communication and finds its application where high data rate is required at low latency and better spectral efficiency. OFDM signals have a generic problem of high peak to average power ratio (PAPR) which is defined as the ratio of the peak power to the average power of the OFDM signal. The drawback of high PAPR is that the dynamic range of the power amplifier (PA) and digital-to-analog converter (DAC) during the transmission and reception of the signal is higher. The main focus of this research is to design & implement a new PAPR reduction scheme based on amplitude clipping & filtering method which reduces the PAPR significantly. Simulation results show the considerable improvement in case of PAPR reduction compare to an existing method. Besides these, overview, motivation & different types of analysis of PAPR reduction techniques are discussed in this book. Orthogonal frequency division multiplexing (OFDM) technology promises to be a key technique for achieving the high data capacity and spectral efficiency requirements for wireless communication systems of the near future. However, OFDM poses high peak-to-average power ratio (PAPR) problem, as a consequence of independently modulated carriers, that causes degradation on the error performance of the system, low efficiency of the power amplifier, and increases the complexities of the system. Reducing the PAPR can be regarded as an important issue to realize efficient and affordable communication services. This study proposes efficient PAPR reduction methods for OFDM signals by decreasing the possibility of peaks of the subcarriers signals to occur at the same time. The achieved results confirm that the proposed methods are capable of reducing the PAPR significantly and, therefore, of improving error performance of the system. The proposed methods were applied to multicarrier code division multiple access (MC-CDMA. In this thesis, a scheme for the identification and classification of orthogonal frequency division multiplexing based signals is proposed. Specifically, the cyclostationary signature of IEEE 802.11 and IEEE 802.16 standard compliant waveforms is investigated. A model is introduced that identifies the waveform; in the case of IEEE 802.11, confirms identification decision via cyclostationary feature extraction. If the waveform is identified as being IEEE 802.16 compliant, the scheme will classify the cyclic prefix size of the waveform. After cyclic prefix classification, the 802.16 waveform will be subjected to cyclostationary feature extraction for identification confirmation. The cyclostationary signature of each waveform is generated via a computationally efficient algorithm called the fast Fourier transform accumulation method, which produces an estimate of the waveform's spectral correlation density function. Simulation results based on MATLAB implementation are presented. New pulse-shaping techniques allow for optical multiplexing with highest spectral efficiencies. We introduce the general theory of orthogonal pulse-shaping and then discuss with more emphasis the orthogonal frequency division multiplexing (OFDM) and Nyquist frequency division multiplexing schemes. Subsequently, we show that rectangularly shaped pulses as used for OFDM can mathematically be treated by the Fourier transform. This leads us to the theory of the time-discrete Fourier transform (DFT) and to a discussion of practical implementations of the DFT and its inverse in the optical domain. The chapter is concluded with exemplary implementations of OFDM transceivers that relay either on direct pulse-shaping or the DFT approaches. Indoor Wi-Fi positioning systems (WPS) are useful for location determination and rely upon the use of existing Wi-Fi hotspot. These systems are advantageous to Global Positioning System (GPS), another popular location positioning system, when GPS is inadequate due to various causes including multi-path and signal blockage. WPS systems measure intensity of the received signal and also applying "fingerprinting" techniques to determine location; however, these systems are only as accurate as the number of locations and number of concurrently received signals from access points that have been entered into a database. In addition, fluctuations in signals due to changes in environment can also have a detrimental effect on accuracy. Understanding the causes that lead to poor indoor positioning system performance as well as techniques that can be used to improve it is very important. Software defined radio (SDR) is an emerging, state-of-the-art technology which features modulation/de-modulation and other techniques in digital signal processing (DSP) in software as opposed to hardware. SDR technology is also very useful in areas where evaluation and analysis of radio frequency (RF) signals is needed. Due to its extreme flexibility, SDR can be modified quickly. SDR lends itself well to the use and evaluation of other deterministic classification techniques which, when applied to RF signals, can be useful for location determination. One such classification technique is Support Vector Machine (SVM) technology. This paper exploits signal propagation multipath as fingerprints in environments with only few available access points which typically result in poor WPS performance. Multipath fingerprints are then used in implementation of an indoor positioning system using a SDR architecture and SVM classification. The SDR architecture is comprised of a popular SDR platform - GNU Software Radio with a new Universal Software Radio Peripherals (USRP) device - USRP Network Series N210. Classification is performed using a popular classification technique - Library SVM (LibSVM). The SDR architecture and classification leverage Orthogonal Frequency Division Multiplexed (OFDM) radio frequency (RF) signals transmitted from another GNU Radio/USRP SDR platform. The study demonstrates the feasibility of using multipath fingerprints for WPS-like positioning that justifies further research on providing better ways to understand the causes that lead to poor indoor positioning system performance as well as techniques that can be used to improve it. Un aspecto fundamental para el diseño de un sistema OFDM con capacidad para proporcionar posicionamiento y comunicaciones a alta velocidad es encontrar una estrategia óptima para asignar la potencia de las señales de datos y las señales pilotos utilizadas en un sistema OFDM. Previamente, diseños para maximizar la capacidad de transmisión de datos del sistema OFDM se han investigado para el caso de canales de comunicación estáticos. Sin embargo, es lógico considerar variaciones del canal para distintos símbolos OFDM causadas por el movimiento ya sea del receptor o transmisor. En este sentido, la capacidad de transmisión de datos para un valor deseado en la precisión de la estimación del "time-delay" se puede mejorar teniendo en cuenta un diseño conjunto de las señales de datos y pilotos. Esto se obtiene considerando la variación temporal del canal y la correlación entre los correspondientes "taps" de canal para distintos símbolos OFDM. En esta tesis presentamos un método para diseñar conjuntamente las señales de datos y pilotos para el caso de canales variantes con el tiempo. Resultados numéricos corroboran la mejora en términos de capacidad de canal para un valor deseado en la precisión de la estimación del "time-delay". A continuación, consideramos la asignación de potencias para OFDM WNL. En redes inalámbricas del tipo "location-aware", los nodos móviles (agentes) pueden obtener sus posiciones utilizando medidas de distancia con respecto otros nodos cuya posición es conocida (anclas). La asignación óptima de potencia para las "subcarriers" de las anclas reduce el error de posicionamiento y mejora el tiempo de vida de la red así como la capacidad de transmisión de datos. En esta tesis presentamos un método de optimización, basado en los límites estadísticos fundamentales, para asignar la potencia de las "subcarriers" de forma ergódica y robusta en localización en redes con conocimiento imperfecto de los parámetros de la red. La asignación de potencia ergódica y robusta se obtiene utilizando los denominados problemas de optimización "semidefinite" en forma tanto iterativa como no-iterativa en transmisiones "unicast" y "multicast". Resultados presentados en esta tesis muestran que una asignación de potencia robusta y ergódica proporciona mayor precisión en el posicionamiento que diseños no robustos cuando existe incertidumbre del canal y en la posición de los agentes. Por último, en esta tesis extendemos las técnicas de localización para sistemas 5G. Las comunicaciones 5G se caracterizan por tener un gran ancho de banda, grandes arrays de antenas y comunicación dispositivo-a-dispositivo. Describimos por qué y cómo estas propiedades contribuyen a la precisión del posicionamiento. También proporcionamos un resumen de cómo las tecnologías 5G se han utilizado en la literatura reciente para proporcionar posicionamiento. En particular, las ondas milimétricas y el "MIMO" masivo son consideradas las tecnologías que posibilitarán las futuras redes 5G. Mientras sus beneficios para obtener grandes velocidades de transmisión de datos son bien conocidos, el potencial de éstas técnicas para proporcionar un posicionamiento preciso es totalmente desconocido. En esta tesis derivamos cotas fundamentales para la precisión de la estimación de la posición y el ángulo de rotación en presencia de "clusters" en sistemas de gran ancho de banda ("wideband"). Un algoritmo de detección basado en 03V "matching pursuit" se utiliza para obtener una estimación aproximada del "AOA"/"AOD" y "TOA". Esta estimación aproximada se utiliza para la inicialización de la fase de estimación basada en la "EM" con un procedimiento secuencial iterativo. Los resultados presentados en la tesis muestran la convergencia de los parámetros estimados hacia los valores obtenidos con la inversa de la matriz de información de Fisher. Orthogonal frequency division multiplexing (OFDM) offers high data rate transmission with high spectral efficiency, immunity to multipath fading, and simple implementation using fast Fourier transform (FFT). OFDM is readily implemented by present day processors in many high speed networks. However, one of the major drawbacks of OFDM systems is the high peak-to-average power ratio (PAPR); this can result in poor power efficiency, degradation in bit-error-rate (BER) performance, and spectral spreading. The effective PAPR reduction of OFDM signals by simple processing has been challenge for the limited power and processing capability of portable OFDM applications. This thesis investigates the problem of high PAPR in OFDM systems and presents many simple implementation PAPR reduction techniques, and one error-resilient technique. The first part of this thesis presents two time-domain PAPR reduction techniques, viz, square-rooting the envelope of the OFDM output signals, and the smoothing technique. The square-rooting process changes the statistical distribution of the OFDM output signals from Rayleigh to Gaussian-like distribution and reduces the differences between the value of peak and average power, which consequently reduces the PAPR significantly. About 6 dB reduction in PAPR is achieved with moderate degradation in BER performance. For the smoothing process, which is derived from the image enhancement technique, the smoothing applied on the OFDM signals mitigates the PAPR due to its averaging effect.

Up to 2.5 dB reduction is achieved by smoothing. Two new probabilistic based non-iterative frequency-domain PAPR reduction techniques are introduced in the second part of the thesis. These techniques reduce PAPR by changing the statistical distribution of the OFDM modulated symbols from uniform distribution to Gaussian-like distribution. This task is performed by two different methods in two different PAPR techniques. The first method of PAPR reduction is done by the addition of complex Gaussian random signals, while the second one is done by insertion of dummy Gaussian subcarriers. The two techniques provide PAPR reduction in the order of 5 dB for PSK-OFDM systems with no out-of-band radiation. The adaptive operation of these techniques enhances significantly both the BER performance and reduce the transmission power. The last part of this thesis presents a new modulation-based error resilient technique referred to as multi-dimensional modulation technique (MDM). In this technique concatenation of digital modulators of decreasing modulation orders are employed. The MDM technique improves the BER performance linearly with increased size of modulation order; up to 12 dB improvement in Eb/No is achieved relative to the conventional OFDM systems at high modulation orders, M≥1024. Also, the MDM technique offers both error resilience and PAPR reduction when it is combined with the conventional OFDM systems in time domain. As a conclusion, the proposed techniques described above offer new solutions to the problem of high PAPR in OFDM systems, and for one of them offer improvement of BER performance at the same time. Besides, they can be applied for different systems parameters and applications requirement. Moreover, the PAPR reduction techniques proposed in this thesis are data-independent and can be implemented in one-shot; while the MDM technique uses only digital modulation and dc-offset signal processing, which can be implemented by simple circuits and/or processors.

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