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Intercarrier Interference Suppression in OFDM Systems OFDM - Orthogonal Frequency Division Multiplexing ~~2.3 - OFDM/ OFDMA IN 4G LTE - PART 1~~ Discrete Convolution, ISI and ICI on DMT/OFDM Systems Lec 30 Introduction and system model for OFDM ~~LTE Radio Primer Part 1: OFDM Signal~~ *Orthogonal Frequency Division Multiplexing - OFDM | Wireless Communication [English]* Lec 8 | Orthogonal Frequency Division Multiplexing | OFDM | Wireless Comunication | ~~Lecture 48: Cyclic Prefix in OFDM Systems~~ *A Novel Inter-Carrier-Interference Free Signal Processing Scheme for OFDM Radar* ~~Introduction to Orthogonal Frequency Division Multiplexing OFDM — Cyclic Prefix CP and Circul~~ **The Basics of the Orthogonal Frequency Division Multiplexing (OFDM)**

System

What is PAPR? and its relationship to OFDM 5G cellular networks: 6 new technologies 2.9 - CARRIER AGGREGATION TECHNIQUE (CA) -CAPACITY \u0026 COVERAGE ENHANCEMENT IN 4G LTE *inter symbol interference:ISI* OFDM technique and its simulation using MATLAB 2.4 - OFDMA/SC-FDMA IN 4G LTE - PART 2 *Principles of Modern CDMA/MIMO/OFDM Wireless Communications by Prof. Aditya K Jagannatham 2.8 - MIMO TECHNIQUES - CAPACITY \u0026 COVERAGE ENHANCEMENT IN 4G LTE* What is a Cyclic Prefix in OFDM? LTE Basics Part I - OFDMA and LTE Frame structures OFDM Systems and its channel estimation LTE Radio Primer Part 2: OFDM Transmitter \u0026 Receiver Comprehensive OFDM-MIMO

Online course-Introduction- Dr. Doron Ezri Lecture 45: Orthogonal Frequency Division Multiplexing (OFDM) BER analysis of conventional and wavelet based OFDM in LTE *Adaptive Pilot Patterns for CA-OFDM Systems in Vehicular Channels* mitigation inter carrier interference in ofdm system using kalman filter **TONE RESERVATION PTS \u0026 COMPANDING APPROACH BASED MULTILEVEL PAPR REDUCTION IN DWT-OFDM SYSTEMS** *Ofdm Systems Based On Inter*

In telecommunications, orthogonal frequency-division multiplexing (OFDM) is a type of digital transmission and a method of encoding digital data on multiple carrier frequencies. OFDM has developed into a popular scheme for wideband digital communication, used in applications such as digital television and audio broadcasting, DSL internet access,

wireless networks, power line networks, and 4G ...

Orthogonal frequency-division multiplexing - Wikipedia

Orthogonal Frequency Division Multiplexing (OFDM) is an emerging multi-carrier modulation scheme, which has been adopted for several wireless standards such as IEEE 802.11a and HiperLAN2. A well-known problem of OFDM is its sensitivity to frequency offset between the transmitted and received carrier frequencies. This frequency offset introduces inter-carrier interference (ICI) in the OFDM symbol.

INTER CARRIER INTERFERENCE CANCELLATION IN OFDM SYSTEMS

Basic concept of OFDM, Orthogonal Frequency Division Multiplexing One

requirement of the OFDM transmitting and receiving systems is that they must be linear. Any non-linearity will cause interference between the carriers as a result of inter-modulation distortion.

What is OFDM: Orthogonal Frequency Division Multiplexing ...

The OFDM scheme differs from traditional FDM in the following interrelated ways: 1. Multiple carriers (called subcarriers) carry the information stream, 2. The subcarriers are orthogonal to each other, and 3. A guard interval is added to each symbol to minimize the channel delay spread and ...

Concepts of Orthogonal Frequency Division Multiplexing ...

Sheng Hong et al. (2019) proposed a signal modulation recognition algorithm based on DL and applied it to the signal

recognition of orthogonal frequency-division multiplexing (OFDM) systems.

(PDF) Deep Learning-Based Signal Modulation Identification ...

istic based on the pilot signals in each individual OFDM data block. Recently, an elegant channel estimation method for OFDM mobile communication systems has been proposed by Zhao and Huang [3]. In this method, the additive white Gaussian noise (AWGN) and the inter-carrier interference (ICI) in the pilot sub-

Channel Estimation For OFDM Systems Based On Comb-Type ...

Abstract—The channel estimation techniques for OFDM systems based on pilot arrangement are investigated. The channel estimation based on comb type pilot arrangement is studied through different algorithms for both estimating

channel at pilot frequencies and interpolating the channel. The estimation of channel at pilot frequencies is based on

Channel Estimation Techniques Based on Pilot Arrangement ...

16 IV. P ERFORMANCE D EMONSTRATION Numerical simulations 5 displaying the BER and throughput performance of OFDM-SPM were conducted. Table I shows the simulation parameters adopted in this study. The system was simulated in a multipath Rayleigh fading environment. The channel is slowly time-varying such that it is assumed to be constant for a block of OFDM symbols, but changes independently ...

OFDM based modulation schemes such as SIM OFDM 32 were ...

Abstract: A spectrally-localized waveform

is proposed based on filtered orthogonal frequency division multiplexing (f-OFDM). By allowing the filter length to exceed the cyclic prefix (CP) length of OFDM and designing the filter appropriately, the proposed f-OFDM waveform can achieve a desirable frequency localization for bandwidths as narrow as a few tens of subcarriers, while keeping the inter-symbol interference/inter-carrier interference (ISI/ICI) within an acceptable limit.

Filtered OFDM: A new waveform for future wireless systems ...

for numerology selection of OFDM systems. Considering the inter-symbol interference (ISI), inter-carrier interference (ICI) and noise level, the SNR loss is established as the objective to be minimized. We extract the power delay pro fi le, mobile velocity and noise power as the input features to the DNN. The

Numerology Selection for OFDM Systems Based on Deep Neural ...

In the design of wireless OFDM systems, the channel is usually assumed to have a fl nite-length impulse response. A cyclic extension, longer than this impulse response, is put between consecutive...

On Channel Estimation in OFDM Systems

29 Mar. First-generation mobile telephony was based on analog technology, while 2G was the first digital communication system that was based in Time Division Multiple Access (TDMA). 3G introduced Code Division Multiple Access, while 4G used Orthogonal Frequency Division Multiple Access (OFDMA) for the Downlink and Digital Fourier Transformation – Spread – OFDMA (DFT-S-OFDMA) for the Uplink. 5G technology is also planning to

use Orthogonal Frequency Division Multiple Access (OFDMA) for ...

5G OFDM Technology - 5G HUB

Abstract: The channel estimation methods for OFDM systems based on a comb-type pilot sub-carrier arrangement are investigated. The channel estimation algorithm based on comb-type pilots is divided into pilot signal estimation and channel interpolation. The pilot signal estimation based on LS or MMSE criteria, together with channel interpolation based on piecewise-linear interpolation or piecewise second-order polynomial interpolation is studied.

Channel estimation for OFDM systems based on comb-type ...

With OFDM, subcarriers are cleverly allocated close to each other. This results in overlapping the spectrum and it

eliminates the spectral utilization drawback of standard FDM without introducing inter-channel interference. OFDM achieves this compacting property, without introducing interference, by making subcarriers orthogonal to each other.

OFDM in LTE - Behind The Sciences

To reduce jointly the OoBE and peak‐to‐average power ratio of the OFDM‐based system, a method called alignment suppression, which generates a suppression signal, has been proposed . As this method utilizes the original redundant CP in the OFDM symbol, it does not reduce transmission efficiency.

Spectral encapsulation of OFDM systems based on ...

ISI and ICI are caused in OFDM based systems. ISI-Inter Symbol Interference. In

OFDM based systems, the transmission takes place symbol by symbol. Before the symbol transmission, symbols are packed with complex modulated data symbols. For example, in WLAN 802.11a based system, one symbol is composed of 64 point FFT.

ISI vs ICI | difference between ISI and ICI

In this letter, we propose a deep neutral network (DNN) approach for numerology selection of OFDM systems. Considering the inter-symbol interference (ISI), inter-carrier interference (ICI) and noise level, the SNR loss is established as the objective to be minimized.

[2011.04247] Numerology Selection for OFDM Systems Based ...

Orthogonal frequency division multiplexing (OFDM) is proved to be the

best candidate to support the colossal increase in mobile users and their required high rate of transmission in frequency selective fading environments, where the inter-symbol interference is at highest.

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

OFDM is a promising technique for high-data-rate wireless communications because it can combat inter-symbol interference (ISI) caused by the dispersive fading of wireless channels. The proposed research focuses on techniques that improve the performance of OFDM-based wireless communications and its commercial and military applications. In particular, we address the following aspects of OFDM: inter-channel interference (ICI) suppression, interference suppression for clustered OFDM, clustered OFDM based anti-jamming modulation, channel estimation for MIMO-OFDM, MIMO

transmission with limited feedback. For inter-channel interference suppression, a frequency domain partial response coding (PRC) scheme is proposed to mitigate ICI. We derive the near-optimal weights for PRC that is independent on the channel power spectrum. The error floor resulting from ICI can be reduced significantly using a two-tap or a three-tap PRC. Clustered OFDM is a new technique that has many advantages over traditional OFDM. In clustered OFDM systems, adaptive antenna arrays are used for interference suppression. To calculate weights for interference suppression, we propose a polynomial-based parameter estimator to combat the severe leakage of the DFT based estimator due to the small size of the cluster. An adaptive algorithm is developed to obtain optimal performance. For high data rate military communications, we propose a clustered

OFDM base spread spectrum modulation to provide both anti-jamming and fading suppression capability. We analyze the performance of uncoded and coded system. Employing multiple transmit and receive antennas in OFDM systems (MIMO-OFDM) can increase the spectral efficiency and link reliability. We develop a minimum mean-square-error (MMSE) channel estimator that takes advantage of the spatial-frequency correlations in MIMO-OFDM systems to minimize the estimation error. We investigate the training sequence design and two optimal training sequence designs are given for arbitrary spatial correlations. For a MIMO system, the diversity and array gains can be obtained by exploiting channel information at the transmitter. For MIMO-OFDM systems, we propose a subspace tracking based approach that can exploit the frequency correlations of the

OFDM system to reduce the feedback rate. The proposed approach does not need recalculate the precoding matrix and is robust to multiple data stream transmission.

A comprehensive review of the most recent applications of intelligent multi-modal data processing Intelligent Multi-Modal Data Processing contains a review of the most recent applications of data processing. The Editors and contributors – noted experts on the topic – offer a review of the new and challenging areas of multimedia data processing as well as state-of-the-art algorithms to solve the problems in an intelligent manner. The text provides a clear understanding of the real-life implementation of different statistical theories and explains how to implement

various statistical theories. Intelligent Multi-Modal Data Processing is an authoritative guide for developing innovative research ideas for interdisciplinary research practices. Designed as a practical resource, the book contains tables to compare statistical analysis results of a novel technique to that of the state-of-the-art techniques and illustrations in the form of algorithms to establish a pre-processing and/or post-processing technique for model building. The book also contains images that show the efficiency of the algorithm on standard data set. This important book: Includes an in-depth analysis of the state-of-the-art applications of signal and data processing Contains contributions from noted experts in the field Offers information on hybrid differential evolution for optimal multilevel image thresholding Presents a fuzzy decision based multi-objective

evolutionary method for video summarisation Written for students of technology and management, computer scientists and professionals in information technology, Intelligent Multi-Modal Data Processing brings together in one volume the range of multi-modal data processing.

This dissertation, "Cyclic Prefix in OFDM Systems" by Zhiqiang, Chen, 陳志強, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Abstract of thesis entitled "Cyclic Prefix in OFDM systems" Submitted by Chen

ZhiQiang for the degree of Doctor of Philosophy at The University of Hong Kong in July 2007 Orthogonal frequency division multiplexing (OFDM) is an efficient multiplexing technology in wireless communications. A guard time, usually in the form of cyclic prefix (CP), is inserted between OFDM symbols to eliminate both the inter-symbol interference (ISI) and the inter-channel interference (ICI). The traditional "one size fits all" CP insertion method sets the CP length longer than the channel maximum excess delay. In contrast, one novel CP insertion method is proposed in this thesis which not only depends on the channel delay profile but also the signal-to-noise ratio (SNR). The numerical results show that the newly proposed CP length outperforms the traditional length in both bandwidth efficiency and power efficiency. Because the insertion of CP requires

additional bandwidth to accommodate the redundancy, many algorithms have been proposed to decrease the CP length at the expense of the transceiver's complexity. The novel method of CP insertion, however, proposes to decrease the CP length without any increase in complexity. The scheme without CP insertion is also proposed for the system working at low SNR regime. Numerical results show that in such a system the scheme without CP insertion yields a significant bandwidth efficiency increase with a penalty of a trivial power efficiency decrease. While hybrid OFDM systems, which are the combinations of OFDM and other technologies such as code division multiple access (CDMA) and multiple-input multiple- output (MIMO) have been the subject of considerable research, the CP insertions in these systems have not been studied sufficiently. These issues are

therefore intensively investigated in this thesis. Firstly, the CP insertion in the point-to-point multi-carrier CDMA (MC CDMA) system, which is the major form of the combination of OFDM and CDMA, is examined. The simulation results show that the optimum CP length decreases with the increase of the spreading gain. Secondly, for the MC CDMA cellular system, a novel CP insertion method based on maximizing the system effective data rate is proposed. It is concluded from the analytical numerical results that the insertion of CP has achieved no benefit and can be discarded. Thirdly, the pairwise error probability (PEP) performance is analyzed and derived for the space time coding OFDM (STC- OFDM) system with insufficient CP. Particularly, the bit error rate (BER) performance is derived for the Alamouti coding OFDM (Alamouti-OFDM) system.

Both the analytical numerical results and the Monte Carlo simulation results show that the optimum CP length decreases as the number of receive antennae increases. Finally, the frame error rate (FER) performance is evaluated for the single-input multiple-output OFDM (SIMO-OFDM) system and MIMO-OFDM system. The simulation results reveal that the insertion of CP can be abandoned while the number of receive antennae is large. In all these situations the schemes without CP insertion require no increase in complexity. DOI: 10.5353/th_b3955833 Subjects: Interference (Sound) Orthogonal frequency division multiplexing

This dissertation, "Semi-blind Signal Detection for MIMO and MIMO-OFDM Systems" by Shaodan, Ma, 馬少丹, was obtained from The University of Hong

Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author. Abstract: Abstract of thesis entitled "Semi-Blind Signal Detection for MIMO and MIMO-OFDM Systems" Submitted by Ma Shaodan for the degree of Doctor of Philosophy at The University of Hong Kong in May 2006 MIMO (Multiple Input Multiple Output) and MIMO-OFDM (Orthogonal Frequency Division Multiplexing) systems have attracted a lot of research interest in recent years due to their potential for future high speed wireless communications. This thesis focuses on the problem of signal detection

and proposes three semi-blind algorithms for MIMO, MIMO-OFDM with short cyclic prefix (CP), and MIMO- OFDM without CP, respectively. A three-step semi-blind Rake-based multi-user detection technique is proposed for quasi-synchronous MIMO systems. The first step separates the multi-user multi-path signal vector into multi-user single-path signal vectors based on second-order statistics (SOS) of the received signals. A simple estimation method is proposed in the second step to estimate the time delays with the aid of pilots. The third step combines multiple multi-user single-path signal vectors for signal detection. System performance is improved by time diversity and only the upper bounds of the channel length and the time delays are required. Simulation results show that the proposed technique achieves good performance and is not sensitive to over-estimation of the

maximum channel length and the maximum time delay. A MIMO-OFDM system with short CP is next considered for higher bandwidth efficiency and a time domain semi-blind signal detection algorithm is proposed. A new system model in which the i th received OFDM symbol is left shifted by J samples is introduced. Based on some structural properties of the new system model, an equalizer is designed using SOS of the received signals to cancel most of the inter-symbol interference (ISI). The transmitted signals are then detected from the equalizer output. In the proposed algorithm, only 2P (P is the number of transmit antennas/users in MIMO-OFDM systems) columns of the channel matrix need to be estimated, and channel length estimation is unnecessary. In addition, the proposed algorithm is applicable irrespective of whether the

channel length is shorter than, equal to or longer than the CP length. Simulation results verify the effectiveness of the proposed algorithm, and show that it outperforms the existing ones in all cases. Finally, in order to further improve bandwidth efficiency, a MIMO-OFDM system without CP is considered and a two-step semi-blind signal detection algorithm is proposed. The algorithm is based on some structural properties derived from shifting the received OFDM symbols. The first step cancels inter-carrier interference (ICI) and ISI with an equalizer designed using SOS of the shifted received OFDM symbols. The second step involves signal detection from the equalizer output in which the signals are still corrupted with multi-antenna interference (MAI). In the proposed algorithm, precise knowledge of the channel length is unnecessary and only one pilot OFDM symbol is utilized to

estimate the required channel state information. Simulation results show that the proposed algorithm achieves comparable performance to algorithms for standard MIMO-OFDM systems and it is robust against channel length overestimation. The number of words: 460 DOI: 10.5353/th_b3684656 Subjects: Signal detection Algorithms MIMO systems Orthogonal

Learn how radio access network (RAN) slicing allows 5G networks to adapt to a wide range of environments in this masterful resource Radio Access Network Slicing and Virtualization for 5G Vertical Industriesprovides readers with a comprehensive and authoritative examination of crucial topics in the field of radio access network (RAN) slicing. Learn

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5G vertical industries in a variety of environments This book is perfect for telecom engineers and industry actors who wish to identify realistic and cost-effective concepts to support specific 5G verticals. It also belongs on the bookshelves of researchers, professors, doctoral, and postgraduate students who want to identify open issues and conduct further research.

In this dissertation, the problem of synchronization for OFDM-based wireless communication systems is studied. In the first part of this dissertation, the sensitivity of both single input single output (SISO) OFDM and multiple input multiple output (MIMO) OFDM receivers to carrier and timing synchronization errors are analyzed. Analytical expressions and numerical results for the power of inter-carrier interference (ICI) are presented. It is shown that the OFDM-based receivers

are quite sensitive to residual synchronization errors. In wide-sense stationary uncorrelated scattering (WSSUS) frequency-selective fading channels, the sampling clock timing offset results in rotation of the subcarrier constellation, while carrier frequency offsets and phase jitter cause inter-carrier interference. The overall system performance in terms of symbol error rate is limited by the inter-carrier interference. For a reliable information reception, compensatory measures must be taken. The second part of this dissertation deals with the impact of spatial diversity (usage of multiple transmit/receive antennas) on synchronization. It is found that with multiple transmit and receive antennas, MIMO-OFDM systems can take advantage of the spatial diversity to combat carrier and timing synchronization imperfections. Diversity can favorably

improve the synchronization performance. Data-aided and non-data-aided maximum likelihood symbol timing estimators for MIMO-OFDM systems are introduced. Computer simulations show that, by exploiting the spatial diversity, synchronization performance of MIMO-OFDM systems in terms of mean squared error (MSE) of residual timing offset becomes significantly more reliable when compared to conventional SISO OFDM systems. Therefore, spatial diversity is a useful technique to be exploited in the deployment of MIMO-OFDM communication systems. In MIMO systems with synchronization sequences, timing synchronization is treated as a multiple hypotheses testing problem. Generalized likelihood ratio test (GLRT) statistics are developed for MIMO systems in frequency flat channels and MIMO-OFDM systems in frequency selective

fading environments. The asymptotic performance of the GLRT without nuisance parameters is carried out. It is shown that the asymptotic performance of the GLRT can serve as an upper bound for the detection probability in the presence of a limited number of observations as well as a benchmark for comparing the performances of different timing synchronizers.

Orthogonal frequency division multiplexing (OFDM) is currently being used predominantly in radio frequency (RF) mobile broadband communication systems because of its ability to combat inter-symbol interference (ISI) and robustness against frequency selective fading caused by multipath wireless channel. Wireless mobile standards like 3G and 4G long term evolution (LTE) use orthogonal frequency division multiple

access (OFDMA) as a multiplexing/modulation scheme. Despite its many advantages like single tap frequency domain equalization and fast discrete time implementation, OFDM suffers from certain disadvantages like high peak-to-average power ratio (PAPR) and high sensitivity to carrier frequency offset (CFO). Although OFDM has solved problems like multipath fading but it cannot solve the emerging problems like scarcity of RF spectrum for mobile wireless broadband applications. Optical wireless (OW) communication has recently gained a lot of attention as a candidate to complement RF communication. It offers advantages like virtually infinite bandwidth, data security and use of low cost transmitters and receivers like solid state light emitting diodes (LEDs) and optical detectors. OFDM is also being considered as a candidate for visible light

communication (VLC) as it offers robustness against multipath caused by diffuse indoor OW channel. One way to realize VLC is intensity modulation direct detection (IM/DD). Although the major difference between RF and OW based OFDM lies in the front end of transmitter and receiver, but due to the unipolar nature of optical intensity in IM/DD system, methods of generating baseband OFDM signal, techniques to reduce PAPR and timing synchronization schemes for RF cannot be directly applied to optical OFDM systems and therefore must be revisited. Therefore, in this thesis, we will first look into the interference caused by CFO in RF based OFDMA system and will analyze the characteristics of this interference for two mapping subcarrier strategies. We will explicitly calculate SINR expression for OFDMA based systems and analyze two types of symbol

mapping strategies and characterize interferences due to CFO for each scheme. We will also develop some techniques to reduce high PAPR in OFDM based OW systems since the non-linear characteristics of LED transmitters can severely affect system performance. We will look into various precoding based PAPR reduction techniques. We will then analyze performance of various OFDM based OW schemes in multipath diffuse indoor wireless channel. We will compare performance of conventional schemes with a precoded version. We will then describe in detail our newly proposed power and spectrally efficient hybrid asymmetrically clipped optical orthogonal frequency division multiplexing (HACO-OFDM) system and compare its performance with previously proposed schemes. Finally, we will present details of our newly proposed timing synchronization scheme for power

efficient asymmetrically clipped (AC) OW OFDM systems. Detailed performance analysis will be presented and a comparison will be developed. Simulation results show that our proposed scheme outperforms all other timing synchronization techniques and exhibits perfect accuracy even at very low signal-to-noise ratio (SNR). Besides performance, our scheme works perfectly for multiple AC OW which proves its high versatility.