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Design and Analysis of MIMO Systems with Practical Channel State Information Assumptions Analysis of MIMO Systems in the Presence of Co-channel Interference and Spatial Correlation Performance Analysis of MIMO Systems with Antenna Selection Over Generalized K − M Fading Channels Phase Analysis of MIMO Systems and Dynamical Networks Measurement-based Analysis of MIMO System Performance in Urban Microcells Analysis of Alternative Massive MIMO Designs An Analysis of MIMO Channel Eigenvalues with Applications to Multiple Beamforming Design and Analysis of MIMO Cooperative Relaying Systems Transmission Analysis of MIMO-SDR Performance Analysis of MIMO-CDMA Systems with Space-Time-Frequency Coding Antenna Analysis and Design for MIMO Systems with Emphasis on Reconfiguration Performance Analysis of MIMO-CDMA System SIDE CHANNEL ANALYSIS WITH MIMO ESTIMATION TECHNIQUES. Capacity Analysis of MIMO Rayleigh Channel with Spatial Fading Correlations and Estimation Errors Antenna Selection and Performance Analysis of MIMO Spatial Multiplexing Systems Performance Analysis of MIMO Relay Networks with Beamforming DMT Analysis for MIMO Broadcast Communication Without Channel State Information at Transmitter Outage Analysis in MIMO Free-space Optical Channels with Pulse-position Modulation Performance Analysis of Massive MIMO in Non-ideal Settings Design and Performance Analysis of MIMO Based WLANs Analysis of MIMO Radar Impact on MIMO Communication System Using Zero-forcing Receiver Una aventura a tu alcance en la ... Performance Analysis of MIMO Cooperation Diversity in Hybrid FDMA-TDMA Performance Evaluation and Analysis of MIMO Schemes in LTE Networks Environment Multi-periodic Repetitive Control System Performance Analysis of Mimo Linear Precoders/decoders Performance Analysis of Feedback Reduction in Mimo System with Spatial Heterogeneity Measurement-based Analysis of Multiple-input Multiple-output Communications Over the Personal Communication Service Spectrum Improved SER Analysis of Joint Diversity Scheme in MIMO Systems Performance Analysis of Iterative Max-sum-rate Algorithm in Massive Mimo Systems From the Conventional MIMO to Massive MIMO Systems A Theoretical Analysis of Mimo Processing Over Copper Twisted-pair Channels Wireless Communications with MIMO Systems: Analysis and Practice Transceivers for MIMO Systems: Design, Analysis and Iterative Decoding Capacity Analysis, Modeling and Simulation of Mimo Channel Analysis and Transceiver Design for the MIMO Broadcast Channel Multiple Input Multiple Output (MIMO) Systems Channel Modeling and Analysis SIMULATION AND PERFORMANCE ANALYSIS OF MIMO-OFDM SYSTEM USING DIFERRENT MODULATION SCHEMES IN SIMULINK ENVIRONMENT Blind Channel Estimation Performance Analysis in MIMO Cyclic Prefixed OFDM Systems A Performance Analysis of MIMO-OFDM/TDM in a Peak-limited Multipath Fading Channel

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Using multiple antennas at both the transmitter and the receiver is one of the most promising techniques that can offer significant increases in channel capacity of a communication system in a wireless fading environment. However, the performance of the MIMO system depends heavily upon the availability of the channel state information (CSI) at the transmitter (CSIT) and at the receiver (CSIR). In this dissertation, we focus our attention on the design and analysis of MIMO systems over wireless fading channels with practical CSI assumptions, which can broadly be divided into the following two categories. The first part considers the development of a general framework for the analysis of multiple antenna systems with finite-rate feedback, wherein the CSI is quantized at the receiver and conveyed back to the transmitter through a rate-constrained reverse link. Inspired by the results of classical high resolution quantization theory, the problem of finite rate quantized communication system is formulated as a general fixed-rate vector quantization problem with side information available at the encoder (or the quantizer) but unavailable at the decoder. The framework of the quantization problem is sufficiently general to include quantization schemes with general non-mean square distortion functions, and constrained source vectors. Asymptotic distortion analysis of the proposed general quantization problem is provided by extending the vector version of the Bennett's integral. Specifically, tight lower and upper bounds of the average asymptotic distortion are provided together with useful insights from a source coding perspective. The proposed general methodology provides a powerful analytical tool to study a wide range

of finite-rate feedback systems which includes both MISO systems over spatially correlated fading channels and MIMO systems over i.i.d. fading channels. The established framework is also versatile enough to provide analysis of sub-optimal mismatched CSI quantizers and quantizers with transformed codebooks. The second part of this dissertation is focused the on the design and analysis of MIMO systems over fading channels with CSI unavailable both at the transmitter and at the receiver. To be specific, we first provide an improved capacity lower bound for MIMO systems with unknown CSI. By analyzing (and optimizing) the proposed capacity lower bound with respect to different system parameters, we improve our intuition and understanding of the effects of training on the overall performance of MIMO systems under unknown CSI assumptions. Moreover, based on the capacity analysis results, we also provide the design of practical LDPC-coded MIMO systems under the same unknown CSI assumption at both component level and structural level. We first propose at the component level several soft-input soft-output MIMO detectors whose performances are much better than the conventional MMSE-based detectors. At the structural level, an unconventional iterative decoding scheme is proposed whose structure leads to a simple and efficient LDPC code degree profile optimization algorithm with proven global optimality and guaranteed convergence from any initialization. We address design of optimal MIMO precoders/decoders in the minimum mean square error (MMSE) sense. Prior work assumes full and perfect channel state information (CSI) at the transmitter, whereas we assume that the CSI has been corrupted in some manner. We re-derive new optimal precoders/decoders based on corrupt CSI. It is shown that the received signal cannot be simplified into parallel subchannels as is performed in previous work to greatly simplify that analysis. The error that corrupts the received signal is described and then bounded. Performance analysis is completed by describing the distribution of the error, SNR/SINR and mutual information equations, along with BER and capacity plots. In this study report, we have analyzed a hybrid FDMA-TDMA access technique in a cooperative distributive fashion implementing a protocol introduced in (Nabar et al., 2004). A wireless network consists of two users terminal, two relays and two destination terminals. The relays are operating in amplify-and-forward (AF) mode with a xed gain. Two operating modes: cooperation-gain mode and power-gain mode are exploited from source terminals to relays, as it is working in a best channel selection scheme. Vertical BLAST (Bell Laboratories Layered Space Time) or V-BLAST with minimum mean square error (MMSE) nulling has operated at the relays to perfectly detect the joint signals from multiple source terminals. The performance have been analyzed of the end-to-end output signal to noise ratio (SNR) using binary phase shift keying (BPSK) modulation scheme and investigated over Rayleigh and independent and identical (i.i.d.) Nakagami-m fading environments. Subsequently, simulation results show that the proposed scheme can provide better signal quality of uplink users in a cooperation communication systems using hybrid FDMA-TDMA technique. Spectrum sharing is an approach to solving the congestion problem in radio frequency (RF) bands. The 3500-3650 MHz band has been allocated in the United States for spectrum sharing between military radar systems and cellular systems. Hence, this paper considers a multiple-input multiple-output (MIMO) radar system and a MIMO communication system sharing the same spectrum band. The performance of the communications system is analyzed by considering interference from the radar with regard to signals reflected at the radar's target. A majority of papers prefer to omit the effect of the target reflection coefficient, which depends on the scattering characteristic of the target. Therefore, in this paper, the target reflection coefficient is integrated, and the scattering effect to the MIMO communications system is analyzed. Also, the power of the transmitted radar waveforms is varied. The direction of the targets is considered, and their impact on the MIMO communication system is analyzed. Using a zeroforcing (ZF) receiver, the bit error rate (BER) of the communication system is simulated. This book deals with the

optimization-based joint design of the transmit and receive filters in MIMO broadcast channel in which the user terminals may be equipped with several antenna elements. Furthermore, the maximum performance of the system in the high power regime as well as the set of all feasible quality-of-service requirements is analyzed. First, a fundamental duality is derived that holds between the MIMO broadcast channel and virtual MIMO multiple access channel. This duality construct allows for the efficient solution of problems originally posed in the broadcast channel in the dual domain where a possibly hidden convexity can often be revealed. On the basis of the established duality result, the gradient-projection algorithm is introduced as a tool to solve constrained optimization problems to global optimality under certain conditions. The gradient-projection tool is then applied to solving the weighted sum rate maximization problem which is a central optimization that arises in any network utility maximization. In the high power regime, a simple characterization of the obtained performance becomes possible due to the fact that the weighted sum rate utility converges to an affine asymptote in the logarithmic power domain. We find closed form expressions for these asymptotes which allows for a quantification of the asymptotic rate loss that linear transceivers have to face with respect to dirty paper coding. In the last part, we answer the fundamental question of feasibility in quality-of-service based optimizations with inelastic traffic that features strict delay constraints. Under the assumption of linear transceivers, not every set of quality-of-service requirements might be feasible making the power minimization problem with given lower bound constraints on the rate for example infeasible in these cases. We derive a complete description of the quality-of-service feasibility region for arbitrary channel matrices. Multiple antenna techniques have been playing a leading role in modern wireless communications due to their advantage of the significant increases in capacity and reliability without additional channel bandwidth or transmit power. Spatial multiplexing, one of the prevailing techniques in the emerging wireless standards, such as 802.11n and 3GPP Long Term Evolution (LTE), can transmit multiple independent signals on the streams offered by the multiple antennas, providing high-speed data connections. In this dissertation, we consider singular value decomposition (SVD) based multiple beamforming where the transmitter as well as the receiver know the path gains on the multi-input multi-output (MIMO) wireless channel. In multiple beamforming, which employs a number of left and right singular vectors for the beamforming matrices, it has been known that diversity gain deteriorates as the number of transmitted signals increases. Bit-interleaved coded multiple beamforming (BICMB) was introduced to overcome the diversity loss of multiple beamforming. In this thesis, an extensive analysis of BICMB diversity gain is performed by calculating pairwise error probability (PEP), which depends on a subset of the eigenvalues of the Wishart matrix, thus requiring the marginal pdf of the eigenvalues for the calculation. We propose a methodology to calculate an upper bound to the marginal pdf of the eigenvalues, and apply it to the diversity analysis. Combined with the Singleton bound, the diversity analysis is also used to find the diversity bound of BICMB. Furthermore, the upper bound to the marginal pdf is applied to the diversity analysis of constellation precoded multiple beamforming (CPMB), which employs the constellation precoding technique in multiple beamforming. As a result, CPMB can achieve full spatial diversity offered by the multiple antennas with any code rate and any number of subchannels used. Multiple Input Multiple Output (MIMO) communications systems equipped with antennas array at both the transmitter and receiver ends are promising schemes to realize higher rate and/or reliable data transmitter and receiver ends are promising schemes to realize higher rate and/or reliable data transmission. In this thesis, capacity analysis of MIMO Rayleigh Channel with spatal correlation at the receiver of multipath is studied. In general, a model configuration of local scatterng around a mobile station in MIMO environment is carried out by simulaton to examine spatial correlation coefficients. Based on statistical properties of the eigenvalues of the eigenvalues of correlated

complex random Wishart matrices, the exact closed-form expressions of distribution of the eigenvalues are investigated. Thaen, the eneral closed-form evaluation of integral form is proposed based on Meijer's G-function. The analytical results demonstrate that the ergodic capacties are improved by increasing the number of the antennas and signal-to-noise ratio (SNR's). Compared with independent identically distributed (iid) Rayleigh channel, the incremental improvement of correlated Rayleigh channel is reduced by spatial fading correlation. The analytical results validated by Monte-Carlo simulations that show a good agreement. In addition to the capacity analysis, the aspect of information theory of a practical MIMO transmission scheme is discussed, namely, spatial multiplexing MIMO system with zero forcing receiver which operating under realistic conditions such as spatially correlation, channel estimation errors, and delay feedback from the receiver to the transmitter. Results are presented for spatially correlated Rayleigh fading channels and estimation errors. It is demonstrated that the capacity of the system suffers degradation when the channel state information (CSI) is not perfect and in spatially correlated signals. A lower bound on mutual information is also derived for flat fading channel with the effective noise power matrix, which lead to simple study of insights. The prime objectives in the development of Next Generation Wireless Communication systems are to increase the link throughput and network capacity. These demands translate into designing systems that have improved spectral efficiency, efficient bandwidth utilization, computationally economical signal processing algorithms and high speed processing hardware. The available frequency spectrum is limited and a very scarce resource. Hence, efficient channel utilization techniques are required to exploit the channel conditions more proficiently. MIMO technology has become popular in wireless communication systems to achieve enhanced spectral efficiency in rich scattering environments. Test-beds are requisite to validate the results of theory and simulations. The focal benefit of a test-bed is the leeway to study and compare different synchronization, channel estimation and detection algorithms in realistic environments. One of the aspirations of this research work is to achieve real-time video transmission over Next Generation Wireless Systems employing MIMO transmission which enables enhanced data rates utilizing the same frequency band. We have tried to describe two aspects of MIMO channels: channel capacity and channel modeling. We have analyzed the channel capacity of static and fading MIMO channels when the channel side information is available both at the transmitter and receiver, and when it is available only at the receiver. We have then modeled the MIMO channel in physical and angular domains to understand how it provides spatial multiplexing with the help of degrees of freedom. In physical domain modeling, we have modeled the MIMO channel in terms of individual physical paths. In angular domain modeling, we have described the MIMO channel with respect to fixed spatial basis functions defined by fixed angles that are determined by the spatial resolution of the antenna arrays. All the simulations have been performed on MATLAB 7.4.0.287 (R2007a). Encryption and decryption technology have been the focus of cryptography research. Side channel attacks have attracted the attention of cryptanalysts as it is a method to attack encrypted electronic devices against their leaked physical information, which is far more effective than the mathematical methods of cryptographic analysis. In this thesis, the model of side channel analysis (SCA) attack is considered as a communication system and MIMO channel estimation is used as a new method of obtaining hypothetical leakage information from the power measurements. It reduces the computational complexity of SCA that uses correlation power analysis (CPA) and compensate for the interruption of the leakage information. The least-square (LS) algorithm is used in estimation and Python examples are provided. The final results demonstrate that our method could effectively help to find the correct secret key. The aim of this topic is to reduce SER in MIMO System.To investigate a joint diversity scheme and various modulation schemes in a multiple-input multiple-output (MIMO) system. The exact SER of the joint diversity scheme can be derived from M-ary

QAM and M-ary PSK modulations in various fading channels. By comparing various fading channels, SER will be reduced and thus performance of SNR in the MIMO systems will be improved.Whenever User increases SER reduced. The development of information and communication technologies (ICT) provides the means for reaching global connectivity that can help humanity progress and prosper. This comes with high demands on data traffic and number of connected devices which are rapidly growing and need to be met by technological development. Massive MIMO, where MIMO stands for multiple-input multiple-output, is envisioned as a fundamental component of next generation wireless communications for its ability to provide high spectral and energy efficiency, SE and EE, respectively. The key feature of this technology is the use of a large number of antennas at the base stations (BS) to spatially multiplex several user equipments (UEs). In the development of new technologies like Massive MIMO, many design alternatives need to be evaluated and compared in order to find the best operating point with a preferable tradeoff between high performance and low cost. In this thesis, two alternative designs for signal processing and hardware in Massive MIMO are studied and compared with the baseline operation in terms of SE, EE, and power consumption. The first design is called superimposed pilot (SP) transmission and is based on superimposing pilot and data symbols to remove the overhead from pilot transmission and reduce pilot contamination. The second design is mixed analog-to-digital converters (ADCs) and it aims at balancing high performance and low complexity by allowing different ADC bit resolutions across the BS antennas. The results show that the baseline operation of Massive MIMO, properly optimized, is the preferred choice. However, SP and mixed ADCs still have room for improvement and further study is needed to ascertain the full capabilities of these alternative designs. Multiple input multiple output (MIMO) systems using multiple transmit and receive antennas are widely considered as the vital breakthrough that will allow future wireless systems to achieve higher date rates and link reliability with limited bandwidth and power resources. In this dissertation, we address four interesting topics in the wireless MIMO systems, in both point-to-point and multiuser environments. First, in a point-to-point MIMO spatial diversity system, usually the probability distribution function (PDF) of the received SNR is rather involved, which leads to the difficulty in analyzing the average symbol error rate (SER). We provide a succinct result at the high SNR region. Second, in point-to-point wireless MIMO communications, in order to protect the transmitted data against random channel impairment, we consider the problem of link adaptation, including rate adaptation and power control to improve the system performance and guarantee certain quality of service. Third, in a multiuser MIMO wireless network, there is another form of diversity called multiuser diversity which can be exploited to increase the system throughput. By analyzing the scheduling gain (defined as the rate difference between the opportunistic scheduling and round-robin scheduling scheme), we provide a complete analysis on the interaction between the spatial diversity and multiuser diversity. Fourth, in a multiuser MIMO wireless network, we propose a crosslayer-based scheduling scheme that exploits Tomlinson-Harashima Precoding (THP) at the physical (PHY) layer to reduce the multiuser scheduling burden at the medium access control (MAC) layer. Compared with some existing scheduling schemes, the proposed scheme greatly reduces the scheduling complexity while simultaneously improves overall system performance. This dissertation considers two different kinds of two-hop multiple-input multiple-output (MIMO) relay networks with beamforming (BF). First, "one-way" amplify-and-forward (AF) and decode-and-forward (DF) MIMO BF relay networks are considered, in which the relay amplifies or decodes the received signal from the source and forwards it to the destination, respectively, where all nodes beamform with multiple antennas to obtain gains in performance with reduced power consumption. A direct link from source to destination is included in performance analysis. Novel systematic upper-bounds and lower-bounds to average bit or symbol error rates (BERs or

SERs) are proposed. Second, "two-way" AF MIMO BF relay networks are investigated, in which two sources exchange their data through a relay, to improve the spectral efficiency compared with one-way relay networks. Novel unified performance analysis is carried out for five different relaying schemes using two, three, and four time slots in sum-BER, the sum of two BERs at both sources, in two-way relay networks with and without direct links. For both kinds of relay networks, when any node is beamforming simultaneously to two nodes (i.e. from source to relay and destination in one-way relay networks, and from relay to both sources in two-way relay networks), the selection of the BF coefficients at a beamforming node becomes a challenging problem since it has to balance the needs of both receiving nodes. Although this "BF optimization" is performed for BER, SER, and sum-BER in this dissertation, the solution for optimal BF coefficients not only is difficult to implement, it also does not lend itself to performance analysis because the optimal BF coefficients cannot be expressed in closed-form. Therefore, the performance of optimal schemes through bounds, as well as suboptimal ones such as strong-path BF, which beamforms to the stronger path of two links based on their received signal-to-noise ratios (SNRs), is provided for BERs or SERs, for the first time. Since different channel state information (CSI) assumptions at the source, relay, and destination provide different error performance, various CSI assumptions are also considered.

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