

Preface

MIMO-OFDM has been recognized as one of the most promising techniques for future communication systems as it supports high data rate transmission, multimedia services over fading channel that is time selective, and frequency-selective fading. This, in turn, has drawn lots of thought among researchers and students, which results in a large number of coding across space, frequency, and time for MIMO-OFDM systems to exploit three types of diversity schemes in wireless communications. Therefore, an effort has been made in this book to introduce different coding schemes to the reader and promote further research in their area of interest.

This book is concerned with the use of the Algebraic Space Time Coding (ASTC) technique combined with Orthogonal Frequency Division Multiplexing (OFDM) to overcome the frequency selectivity channel problems. The first part analyzed the performance of the ASTC codes under a correlated Rayleigh channel. The Algebraic Space Time Codes (ASTC), based on the cyclic algebras, has shown good spectral efficiency, full diversity, and a full rate under nonselective channel conditions. However, the radio-mobile channel is a selective channel whose features vary with the time. This selectivity is owed to the multi-path phenomenon and generates interferences between symbols (IES). So, the second objective of was to develop a new technique in order to adapt the ASTC codes to the frequency selective channels. It has been shown that by their construction, the Algebraic Space Time Codes have a reasonable BER when working in a nonselective channel thanks to their properties (full rank, full rate, and nonvanishing determinant for increasing rate). We have proved that it is possible to combine MIMO-OFDM systems with an ASTC encoder under a frequency-selective channel. Computer simulations have shown the efficiency of the proposed ASTC encoder either in terms of BER performance, capacity, or in terms of PAPR reduction. The third part aimed to minimize the sensibility of the ASTC codes to frequency synchronization in selective channels. A new algebraic Carrier Frequency Offset (CFO) estimation technique, for MIMO-OFDM systems with ASTC under quasi-static correlated Rayleigh frequency-selective fading channels, has been developed. The technique uses a preamble and is especially suitable for burst mode communication.

The preamble consists of orthogonal training sequences simultaneously transmitted from the various transmit antennas. The proposed system exploits all the subcarriers in frequency domain, which provides a remarkable performance improvement compared to other well-known methods and reaches the Cramèr-Rao Lower Bound (CRLB).

This book also addresses multiuser MIMO-OFDM systems which benefit from the combined space and frequency domain freedom as well as multiuser diversity. To achieve high symbol rate for multiuser MIMO-OFDM system, two coding schemes have been presented for space–frequency (SF) codes and space–time–frequency (STF), where a systematic design of high-rate, full-diversity multi-user SF and STF codes for MIMO frequency-selective fading multiple access channel has been discussed. The book highlights the unique design issues which put the reader in good pace to be able to understand the coding theory and grasp the processes involved.

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