

ABSTRACT

Space Time Coding is a communication technique for wireless systems that employs multiple transmit antennas in addition to multiple receiver antennas. This is becoming a compulsory technology to reduce the operating region of signal to noise ratios. With the ever increasing demand for high data rate, these systems need to be implemented under frequency selective fading conditions, sometimes subject to severe Inter Symbol Interference (ISI). Therefore finding a means to use the existing Space Time Codes which were originally designed for frequency nonselective channels is essential. The real usage of these codes depends on the channel state information available at the receiver side for the decoding. Therefore channel estimation plays a vital role and finding a better method for channel estimation is an important problem.

The use of Orthogonal Frequency Division Multiplexing (OFDM) together with Space Time Codes makes the frequency selective channels frequency nonselective due to the increased symbol duration of the OFDM symbols. Channel estimation could be done using several methods. Least Square (LS) Error based channel estimation and Minimum Mean square Error (MMSE) based channel estimation are some of the available channel estimation methods for Space Time Coded OFDM systems. MMSE estimation is more complex than LS but superior in performance.

In this thesis, we evaluate the performance and complexity of LS and MMSE channel estimation methods for Space Time Coded OFDM systems. This also considers the application of MMSE based channel estimation method to different Space Time Codes with different modulation schemes. The performance of this channel estimation method and the state of system complexity in the above mentioned situations were also evaluated. We have also considered a low complexity Eigen Vector Decomposition based channel estimation method. The performance of the system was simulated with two transmit and two receive antennas. It has been clearly shown that the MMSE channel estimation method performs better with higher number of states in the Space Time Codes and with higher modulation schemes. The Eigen Vector Decomposition based channel estimation brings a low complexity solution.

Pilot Sequence Aided Channel Estimation for Space Time Codes for High Data Rate Wireless Communications

By

Kukajini Thillainathan

This thesis was submitted to the Department of Electronic and Telecommunication Engineering of the University of Moratuwa in partial fulfillment of the requirements for the degree of Master of Science.

University of Moratuwa



82549

Department of Electronic and Telecommunication Engineering
Faculty of Engineering
University of Moratuwa
Sri Lanka

September 2004