

OPTIMUM RECEIVER DESIGN AND PERFORMANCE ANALYSIS
FOR WIRELESS COMMUNICATION

Jingxian Wu

Dr. Chengshan Xiao, Dissertation Supervisor

ABSTRACT

This dissertation is devoted to the optimum receiver design and theoretical performance analysis of wireless communication systems operated over fading channels, and this objective is incarnated by means of design, analysis and simulation of a broad range of wireless communication systems under various practical system configurations. A statistical discrete-time system model is proposed for wireless communication systems, and it provides a generic analysis and simulation framework for the design and evaluation of wireless communication systems. Based on the statistical properties of the discrete-time model, we next develop a multiuser channel estimation algorithm for quasi-synchronous CDMA systems operated over doubly selective Rayleigh fadings, and an optimum diversity receiver is proposed for systems with channel estimation error. Theoretical performance analyses are carried out to investigate the effects of channel estimation error, doubly selective fading, receiver timing phase offset, and co-channel interference on system performance. The theoretical performance expressions presented in this dissertation provide a set of analytical tools for communication system design and evaluation. In addition, all of the analytical results presented in this dissertation are rigorously verified through extensive numerical simulations, and excellent agreements are observed between the simulation results and theoretical expressions.