ROBUST RECEIVER DESIGN FOR RF COMMUNICATION AND UNDERWATER ACOUSTIC COMMUNICATION

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ABSTRACT

This dissertation includes two parts: robust receiver design for wireless radio frequency (RF) communication, and robust receiver design for underwater acoustic (UWA) communication. The methodology of study for the first part is theoretical analysis and numerical simulation, while the research in the second part relies on experimental data collected at undersea field trials.

In the first part, four different topics relating to receiver design are investigated for future wireless RF communication. It starts with an important issue on equivalent discrete-time channel modeling, as the basis for other topics. Based on the proper channel modeling, a practical Doppler spread estimation method is proposed for mobile orthogonal frequency-division multiplexing (OFDM) systems. The last two topics deal with channel estimation for OFDM systems, and turbo equalization for multiple-input, multiple-output (MIMO) systems. Two high-performance turbo equalization algorithms have been developed.

In the second part, two receiver schemes are proposed for high data rate UWA communication. The first scheme combines conventional linear equalization with a novel phase compensation to combat undesirable phase rotations in the received signal. The second scheme performs iterative detection relying on powerful turbo equalization technology. Both receiver designs have been tested by experimental data collected at several undersea field trials.