ABSTRACT

MIMO systems employ multiple transmit and multiple receive antenna elements. These systems substantially improve the data rate of transmission and reliability of reception without any additional bandwidth. High data rates are achieved by using spatial multiplexing techniques, in which multiple data streams are transmitted simultaneously. Increase in reliability is achieved by exploiting spatial diversity. Though MIMO systems are attractive, the systems demand high signal processing and hardware complexity and cost. An important contributor to the complexity and cost is radio-frequency chains (RFCs) in transmitter and receiver. Antenna selection is a technique, which addresses some of the hardware complexity and cost issues of MIMO systems. In this technique, available RFCs are fewer in number than the available antenna elements. Out of the available antenna elements, only as many antenna elements as equal to the number of RFCs will be selected. The selection must be such that its speed must be fast enough and it must fetch maximum capacity. Hence, it is necessary to devise good performance/complexity tradeoff fetching algorithms.

This thesis investigates capacity-maximising antenna selection algorithms for their performance/complexity tradeoffs. It is assumed that the channel is a slow-varying one and instantaneous channel information is necessary for antenna selection. The thesis proposes new capacity-
maximising single-side-only antenna selection algorithms, double-side antenna selection algorithms and extends existing capacity–maximising antenna selection single-side-only algorithms as double-side algorithms for antenna selection. First, a novel receive-only antenna selection scheme is proposed. The exact complex–complex flops are calculated and complexity expressions are formed. To make things closer to practical implementations, complex–complex flops are converted to real–real flops. For existing algorithms, pseudo-statements are framed and the exact real–real flops are calculated. Simulations are carried out and conclusions are drawn on the supremacy of the performance/complexity tradeoff of the proposed algorithm. Then, the existing algorithms and the proposed algorithm are extended as transmit/receive algorithms in a decoupled sense and the exact complexity in real–real flops is calculated. Numerical simulations are carried out to investigate the performance/complexity tradeoff of the extended algorithms. Three simple and sub-optimal norm-based transmit/receive algorithms are proposed and their performance/complexity tradeoffs are analysed. Then, all the transmit/receive algorithms are investigated in unison for their performance/complexity tradeoffs and conclusions are drawn. Finally, the investigations are summarized, implementations in wireless standards are pointed out and future directions are given.