Preface

The demand for wireless and high-rate communication system is increasing gradually, and multiple input multiple-output (MIMO) is one of the feasible solutions to accommodate the growing demand for its spatial multiplexing and diversity gain. However, with high number of antennas, the computational and hardware complexity of MIMO increases exponentially. This accumulating complexity is a paramount problem in MIMO detection system, directly leading to large power consumption. Hence, the major focus of this book is algorithmic and hardware development of MIMO decoder with reduced complexity for both real and complex domain, which can be a beneficial solution with power efficiency and high throughput. Both hard and soft domain MIMO detectors are considered.

The use of lattice reduction (LR) algorithm and on-demand child expansion for the reduction of noise propagation and node calculation, respectively, are two of the key features of our developed architecture, presented in this literature. The real domain iterative soft MIMO decoding algorithm, simulated for 4×4 MIMO with a different modulation scheme, achieves 1.1–2.7 dB improvement over Least Sphere Decoder (LSD) and more than 8× reduction in list size, K, as well as complexity of the detector.

Next, the iterative real domain K-Best decoder is expanded to the complex domain with new detection scheme. It attains 6.9–8.0 dB improvement over real domain K-Best decoder and 1.4–2.5 dB better performance over conventional complex decoder for 8×8 MIMO with 64 QAM modulation scheme. Besides K, a new adjustable parameter, *Rlimit*, has been introduced in order to append reconfigurability trading-off between complexity and performance.

All of the proposed decoders mentioned above are bounded by the fixed K. Hence, an adaptive real domain K-Best decoder is further developed to achieve the similar performance with less K, thereby reducing the computational complexity of the decoder. It does not require accurate SNR measurement to perform the initial estimation of list size, K. Instead, the difference between the first two minimal distances is considered, which inherently eliminates complexity.

In Summary, a novel iterative K-Best detector for both real and complex domain with efficient VLSI design is proposed in this book. The results from extensive simulation and VHDL with analysis using Synopsys tool are also presented for justification and validation of the proposed works.

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