Complexity Reduction of Matrix Manipulation for Multi-User STBC-MIMO Decoding

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Abstract

This paper studies efficient complex valued matrix manipulations for multi-user STBC-MIMO decoding. A novel method called Alamouti blockwise analytical matrix inversion (ABAMI) is proposed for the inversion of large complex matrices that are based on Alamouti sub-blocks. Another method using a variant of Givens rotation is proposed for fast QR decomposition of this kind of matrices. Our solutions significantly reduce the number of operations which makes them more than 4 times faster than several other solutions in the literature. Furthermore, compared to fixed function VLSI implementations, our solution is more flexible and consumes less silicon area because the hardware is programmable and it can be reused for many other operations such as filtering, correlation and FFT/IFFT. Besides the analysis of the general computational complexity based on the number of basic operations, the computational latency is also measured in clock cycles based on the conceptual hardware for real-time matrix manipulations.