

On the Joint Impact of Hardware Impairments and Imperfect CSI on Successive Decoding

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Abstract

In this paper, a spatial multiplexing multiple-input multiple-output (MIMO) system when hardware along with RF imperfections occur during the communication setup is analytically investigated. More specifically, the scenario of hardware impairments at the transceiver and imperfect channel state information (CSI) at the receiver is considered, when successive interference cancellation (SIC) is implemented. Two popular linear detection schemes are analyzed, namely, zero forcing SIC (ZF-SIC) and minimum mean-square error SIC (MMSE-SIC). New analytical expressions for the outage probability of each SIC stage are provided, when independent and identically distributed Rayleigh fading channels are considered. In addition, the well-known error propagation effect between consecutive SIC stages is analyzed, while closed-form expressions are derived for some special cases of interest. Finally, useful engineering insights are manifested, such as the achievable diversity order, the performance difference between ZF- and MMSE-SIC, and the impact of imperfect CSI and/or the presence of hardware impairments to the overall system performance.

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