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A tensor-based approach for frequency-selective MIMO channel equalization

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Abstract
In this paper, a novel tensor-based method is proposed to equalize frequency-selective multiple-input multiple-output (FS-MIMO) channels. Since both the spatial and temporal aspects of such channels are considered in the proposed method at the same time, it has the capability of simultaneously removing both the inter-channel interference and inter-symbol interference of such channels. In this method, a novel HOSVD-based coding scheme is applied to the input and output signals of an FS-MIMO channel modeled by a tensor. The performance of the proposed method is studied for different numbers of antennas at the transmitter and receiver sides and the paths between them. Simulation results show that under the same circumstances, the proposed HOSVD-based equalization method has a much better performance than that of a standard MIMO-OFDM system. This is a very interesting result since although the MIMO-OFDM systems are widely used commercially, they suffer from some important shortcomings. The computational complexity of the proposed method is also analyzed and it is observed that it has much lower complexity than several popular equalization methods for the special case of flat channels, although according to the bit error rate, it easily outperforms them, especially at low SNRs. The effect of incorrect CSI at the transmitter and receiver sides and ill-conditioned channels on the performance of the proposed method is studied, as well.

Keywords Tensor algebra · Channel equalization · Frequency-selective MIMO channels · Higher-order SVD (HOSVD) · Computational complexity

1 Introduction

MIMO technology is being widely used in many wireless and RF applications, including Wi-Fi, LTE and WiMAX (Murch & Ben Letaief, 2002), and is a key element of standards like

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