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Iterative LDPC Coded MIMO Multiple Access with MMSE

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Abstract

An efficient scheme for the multiple-access MIMO channel is proposed, which operates well also in the single user regime, as well as in a DS-CDMA regime. The design features scalability and is of limited complexity. The system employs optimized LDPC codes and an efficient iterative (belief propagation) detection which combines Linear Minimum Mean Square Error (LMMSE) and iterative interference cancellation. Asymptotic density evolution is used to optimize the degree polynomials of the underlining LDPC code, and thresholds as close as 0.77 dB to the channel capacity is evident for a system load of 2. Replacing the LMMSE with the complex individually optimal multiuser detector (IO-MUD) further improves the performance up to 0.14 dB from the capacity. Comparing the thresholds of good single-user LDPC code to the multiuser optimized LDPC code both on the above multiuser channel reveals surprising 8 dB difference. The asymptotic analysis of the proposed scheme is verified by simulations of finite systems, which reveal meaningful differences between performances of MIMO systems with single and multiple users and demonstrate similar performance to previously reported techniques, but with higher system loads, and significantly lower receiver complexity.

Index Terms

MIMO, LDPC, multiuser, CDMA, iterative decoding.

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