Electrical Engineering Colloquium
IEEE Signal Processing Society – Dallas Chapter

"Channel Estimation and Equalization for Distributed Space-Time Coded Systems"

Dr. Murat Uysal
University of Waterloo, Canada

Thursday, October 21, 2004
ECSN 2.120, 11:00am

It has been recently demonstrated that "cooperative diversity", also known as "user cooperation", provides an effective way of improving spectral and power efficiency of the wireless networks without the additional complexity of multiple antennas. Most of the ongoing research efforts in the area of cooperative diversity consider an idealized transmission environment, where perfect channel estimation is assumed. In the first part of this talk, we discuss channel estimation for cooperative diversity schemes. Specifically, we investigate maximum likelihood sequence estimation for a relay assisted space-time block coded (STBC) system operating in amplify-and-forward mode without assuming channel knowledge. Our performance analysis through pairwise error probability derivation demonstrates that maximum diversity order is achievable for the proposed noncoherent receiver under appropriate power control imposed on relay terminals. Furthermore, we provide a performance analysis of pilot symbol assisted modulation (PSAM) technique as a benchmark in the considered cooperative scenario. Our comparative analysis reveals out that the proposed receiver structure significantly outperforms PSAM, providing a robust solution for relay assisted transmission.

In the second part of the talk, we discuss equalization methods for cooperative diversity schemes over frequency-selective channels. Specifically, we consider three equalization schemes proposed originally for conventional STBC and extend these schemes for distributed STBC in a relay-assisted transmission scenario, carefully exploiting the underlying orthogonality. The distributed STBC equalization schemes are named after their original counterparts as Distributed Time-Reversal (D-TR) STBC, Distributed Single-Carrier (D-SC) STBC and Distributed Orthogonal Frequency Division Multiplexed (D-OFDM) STBC. Several practical considerations such as the power imbalance between user terminals, imperfect channel estimation and effects of outer coding are investigated within the context of user cooperation, providing detailed comparisons among the three competing schemes.

Murat Uysal received the Ph.D. degree in electrical engineering from Texas A&M University, College Station, Texas, in 2001. In April 2002, he joined the Department of Electrical and Computer Engineering, University of Waterloo, Canada, as an Assistant Professor. Dr. Uysal is an Editor for IEEE Transactions on Wireless Communications and an Associate Editor for IEEE Communications Letters. He also served as a Guest Co-Editor for Wiley Journal on Wireless Communications and Mobile Computing's Special Issue on "MIMO Communications".

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