THE CHINESE UNIVERSITY OF HONG KONG
Institute of Network Coding
and
Department of Information Engineering
Seminar

MIMO Two-Way Relaying: A Space-Division Approach

by

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Time : ~~11:00 am - 12:00 pm~~ 2:30 - 3:30 pm
Venue : ~~Room 833 , Ho Sin Hang Engineering Building~~
Room 1009, William M.W. Mong Engineering Building
The Chinese University of Hong Kong

Abstract
Multi-antenna two-way relaying, in which two multi-antenna users exchange information via a multi-antenna relay, has attracted much research interest recently. How to approach the capacity of a multiple-input multiple-output (MIMO) two-way relay channel (TWRC) remains a challenging issue. In this work, we propose a novel space-division based network-coding scheme for MIMO two-way relaying. In the proposed scheme, the overall signal space at the relay is divided into two subspaces. In one subspace, the spatial streams of the two users have nearly orthogonal directions, and are completely decoded at the relay. In the other subspace, the signal directions of the two users are nearly parallel, and linear functions of the spatial streams are computed at the relay, following the principle of physical-layer network coding (PNC). Based on the recovered messages and message-functions, the relay generates and forwards network-coded messages to the two users. We show that, at high signal-to-noise ratio (SNR), the proposed scheme achieves the asymptotic sum-rate capacity of MIMO TWRCs within $1/2\log(5/4) \approx 0.161$ bits per user-antenna for any antenna configuration and channel realization. We further perform large-system analysis to derive the average sum-rate of the proposed scheme over Rayleigh-fading MIMO TWRCs. We show that the average asymptotic sum-rate gap to the capacity upper bound is at most 0.053 bits per relay-antenna. It is demonstrated that the proposed scheme significantly outperforms the existing schemes.

Biography
Xiaojun Yuan received the B.S. degree in electronic and information systems from Shanghai Jiaotong University, the M.S. degree in circuit and systems from Fudan University, and the Ph.D. degree in electrical engineering from City University of Hong Kong. During 2009-2010, he was working as a visiting post-doc fellow at the University of Hawaii at Manoa. He is now a research assistant professor at the Institute of Network Coding, The Chinese University of Hong Kong. His research interest falls into the general area of signal processing, communications, and information theory, including channel coding and coded modulation, wireless multi-antenna and multi-user communications, and physical-layer network coding (PNC), etc. He has published over 40 refereed journal and conference papers in the related areas. He is a member of IEEE, and has also served as the Technical Program Committee (TPC) members for many international conferences including WCNC, PIMRC, ICC, etc.

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