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

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Joint Channel Coding and Physical Layer Network Coding Design for Gaussian Two-Way Relay Channels

by

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Date : **7 September 2011 (Wednesday)**
Time : **2:30 - 3:30 pm**
Venue : **Room 833, Ho Sin Hang Engineering Building**
The Chinese University of Hong Kong

Abstract

Joint channel coding and physical layer network coding (CPNC) can enhance the throughput of wireless networks. In this work, we investigate a joint CPNC scheme for Gaussian two-way relay channels. The messages of two users are encoded with the same binary linear code and are transmitted simultaneously with equal power. The relay computes and forwards the network codeword without completely decoding both users' messages. First we study the distance spectrum of the CPNC scheme and derive an asymptotically tight performance bound for the error probability at the relay. We show that the error performance of the CPNC scheme has an asymptotic SNR degradation of at most $\ln 2 \approx 0.6931$ (in linear scale), relative to the single-user relay system with the same channel code. This is equivalent to an SNR degradation less than 1 dB for the medium-to-high SNR range and the gap diminishes as SNR increases. Then, we study how to design capacity approaching irregular repeat-accumulate (IRA) codes for Gaussian two-way relay channels. The equivalent Tanner Graph of the joint CPNC code is investigated and the message update rules for the ternary symbols in the network decoder are derived. We proposed a method to model the a priori information for iterative decoding in the PNC scheme. The model can facilitate the convergence analysis and the code design based on extrinsic information transfer (EXIT) chart. As an example for our design approach, we construct an IRA coded PNC scheme which outperforms the regular RA coded PNC scheme by 2.4 dB.

Biography

Jinhong Yuan received the B.E. and Ph.D degrees in electronics engineering from Beijing Institute of Technology, Beijing, China, in 1991 and 1997, respectively. From 1997 to 1999 he was a Research Fellow at the School of Electrical Engineering, the University of Sydney, Sydney, Australia. In 2000 he joined the School of Electrical Engineering and Telecommunications, the University of New South Wales, Sydney, Australia, where he is currently a Professor for Telecommunications of the school. He has published two books, two book chapters and over 150 papers in telecommunications journals and conference proceedings. His publication is available from http://www2.ee.unsw.edu.au/wcl/JYuan.html. His current research interests include error control coding and information theory, communication theory, and wireless communications.

**ALL ARE WELCOME **

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