The University of New South Wales

Faculty of Engineering

School of Electrical Engineering & Telecom

Invited Talk

Gaussian Relay Channels with Correlated Noises

Shuguang Cui

Assistant Professor

Texas A&M University, USA

Date: 20 April 2010, Tuesday

Time: 2:00 p.m. – 3:00 p.m.

Venue: G3, Electrical Engineering Building

Abstract

In this work, we consider full-duplex and half-duplex Gaussian relay channels where the noises at the relay and destination are arbitrarily correlated. We first derive the capacity upper bound and the achievable rates with three existing schemes: Decode-and-Forward (DF), Compress-and-Forward (CF), and Amplify-and-Forward (AF). We present two capacity results under specific noise correlation coefficients, one being achieved by DF and the other being achieved by direct link transmission (or a special case of CF). The channel for the former capacity result is equivalent to the traditional Gaussian degraded relay channel and the latter corresponds to the Gaussian reversely-degraded relay channel. For CF and AF schemes, we show that their achievable rates are strictly decreasing functions over the negative correlation coefficient. Through numerical comparisons under different channel settings, we observe that although DF completely disregards the noise correlation while the other two can potentially exploit such extra information, none of the three relay schemes always outperforms the others over different correlation coefficients. Moreover, the exploitation of noise correlation by CF and AF accrues more benefit when the source-relay link is weak. This paper also considers the optimal power allocation problem under the correlated-noise channel setting. With individual power constraints at the relay and the source, it is shown that the relay should use all its available power to maximize the achievable rates under any correlation coefficient. With a total power constraint across the source and the relay, the achievable rates are proved to be concave functions over the power allocation factor for AF and CF under full-duplex mode, where the closed-form power allocation strategy is derived.

Biography

Dr. Cui received his Ph.D. in Electrical Engineering from Stanford University, California, USA, in 2005, M.Eng in Electrical Engineering from McMaster University, Hamilton, Canada, in 2000, and B.Eng. in Radio Engineering with the highest distinction from Beijing University of Posts and Telecommunications, Beijing, China, in 1997. He is now working as an assistant professor in Electrical and Computer Engineering at the Texas A&M University, College Station, TX. His current research interests include resource allocation for constrained networks with convex optimization techniques, network information theory, statistical signal processing, and general communication theories. His research has won two conference best paper awards and seven NSF/DoD grant awards. He has been serving as the TPC co-chairs for the 2007 IEEE Communication Theory Workshop, the ICC'08 Communication Theory Symposium, and the GLOBECOM'10 Communication Theory Symposium. He has also been serving as the associate editors for the IEEE Transactions on Wireless Communications, IEEE Communication Letters, and IEEE Transactions on Vehicular Technology, and the elected member for IEEE Signal Processing Society SPCOM Technical Committee.

*** * * * *   ALL ARE WELCOME   * * * * *   For ENQUIRIES: Dr. Wei Zhang (Ph: 9385 4033)**