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香港中文大學
The Chinese University of Hong Kong

Institute of Theoretical Computer Science and Communications

IE - ITCSC Joint Seminar

Cooperative Interference Management in Multi-Cell Downlink Beamforming

By
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January 12, 2010 (Tuesday)

2:30pm - 3:30pm

Rm. 121, Ho Sin Hang Engineering Building, CUHK

Abstract:

We study the downlink beamforming for a multi-cell system, where multiple base stations (BSs) each with multiple antennas cooperatively design their respective transmit beamforming vectors to optimize the overall system performance. It is assumed that all mobile stations (MSs) are equipped with a single antenna each, and there is one active MS in each cell at one time. Accordingly, the system of interest can be modeled by a multiple-input single-output (MISO) Gaussian interference channel (IC), termed as MISO-IC, with interference treated as additive Gaussian noise. We are interested in designing a multi-cell cooperative downlink beamforming scheme to achieve different rate-tuples for active MSs on the Pareto boundary of the achievable rate region for the MISO-IC, which is in general a non-convex problem due to the coupled signal structure. By exploring the relationship between the MISO-IC and the cognitive radio (CR) MISO channel, we show that each Pareto-boundary rate-tuple of the MISO-IC can be achieved in a decentralized manner when each of the MSs attains its own channel capacity subject to a certain set of interference-power constraints (also known as interference-temperature constraints in the CR system) at the other MS receivers. Furthermore, we show that this result leads to a decentralized algorithm for implementing the multi-cell cooperative downlink beamforming, where all different pairs of BSs independently search for their mutually desirable interference-temperature constraints, under which their respective beamforming vectors are optimized to maximize the individual transmit rates. It is shown that this algorithm guarantees to improve the rates for a given pair of BSs at each iteration with those for the other BSs unaffected, and converges when there are no further incentives for all the BSs to adjust their mutual interference-temperature constraints.

(This is based on a joint work with Dr. Rui Zhang from I^2R, A-Star, Singapore.)

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Biography:

Shuguang Cui received his Ph.D in Electrical Engineering from Stanford University, California, USA, in 2005. 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, network information theory, statistical signal processing, and general communication theories. He was a recipient of the NSERC fellowship from the National Science and Engineering Research Council of Canada, the Canadian Wireless Telecommunications Association (CWTA) scholarship, the CROWNCOM'07 and WCSP'10 best paper awards, three NSF grant awards, and three DoD grant awards. He has been serving as the TPC 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 Communication Letters and IEEE Transactions on Vehicular Technology, and the elected member for IEEE Signal Processing Society SPCOM Technical Committee (2009~2012).

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