



THE CHINESE UNIVERSITY OF HONG KONG
Department of Information Engineering

Seminar

Globally Optimal Linear Precoders for Finite Alphabet Signals Over Vector Channels: Theory, Algorithm and Hardware Implementation

by

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FIEEE

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Venue : Room 833 Ho Sin Hang Engineering Building
The Chinese University of Hong Kong

Abstract

In this talk, Prof. Xiao will present new results on the design optimization of linear precoders for maximizing the mutual information between finite alphabet input and the corresponding output over complex-valued vector channels. This mutual information is a nonlinear and non-concave function of the precoder parameters, posing a major obstacle to precoder design optimization. The new results include three main contributions: First, it is proved that the mutual information is a concave function of a matrix which itself is a quadratic function of the precoder matrix. Second, a parameterized iterative algorithm is proposed for finding optimal linear precoders to achieve the global maximum of the mutual information. The proposed iterative algorithm is numerically robust, computationally efficient, and globally convergent. Third, it is demonstrated that maximizing the mutual information between a discrete constellation input and the corresponding output of a vector channel not only provides the highest practically achievable rate but also serves as an excellent criterion for minimizing the coded bit error rate. Numerical examples show that the proposed algorithm achieves mutual information very close to the channel capacity for channel coding rate under 0.75, and also exhibits a large gain over existing linear precoding and/or power allocation algorithms. Furthermore, FPGA-based hardware implementation will be presented as well.

Biography

Chengshan Xiao is a Professor of Electrical and Computer Engineering at Missouri University of Science and Technology, Rolla, Missouri, USA. Previously, he was a Lecturer with the Department of Electronic Engineering at Tsinghua University, Beijing, China. His research interests include wireless communications, signal processing, and underwater acoustic communications. He is the holder of three U.S. patents. His algorithms have been implemented into Nortel's base station radios after successful technical field trials and network integration.

Prof. Xiao is the Editor-in-Chief of the IEEE Transactions on Wireless Communications, a Fellow of the IEEE, a Fellow Evaluation Committee Member of IEEE Communications Society (ComSoc), a Member at Large of IEEE ComSoc Board of Governors, and a Distinguished Lecturer of IEEE ComSoc. Previously, he served as the founding Chair of the IEEE Technical Committee on Wireless Communications, and the Technical Program Chair of the 2010 IEEE International Conference on Communications, Cape Town, South Africa.

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