

Reduced-Rank Multi-User Detectors for CDMA Systems

by Hongya Ge, ECE Dept., NJIT

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About the Speaker

Hongya Ge received the B.S. degree from the University of Electronic Science and Technology of China (UESTC), Chengdu, China; the M.S. degree from the Nanjing University of Aeronautics and Astronautics, Nanjing, China; and the Ph.D. degree from the University of Rhode Island, Kingston, RI, in 1982, 1985, and 1994, respectively, all in electrical engineering. From 1986 to 1990, she was with the Department of Information and Electronics at the Zhejiang University, as a lecturer, teaching and researching in Radar Signal Processing, Communication Theory, and Numerical Analysis. Since 1995, she has been with the Department of Electrical and Computer Engineering, New Jersey Institute of Technology, Newark, NJ, where she is currently an associate professor. During the academic year of 2000-2001, she was a visiting scientist in the Applied Research Department of Telcordia Technologies, Inc. NJ, working on broadband wireless access, MIMO transceiver systems, and wireless network security projects. During the academic year of 2003-2004, she spends her sabbatical leave with the Colorado State University and the Nanyang Technological University, Singapore. Her research interests are in the general areas of Statistical Signal and Array Processing, Transceiver Design for Wireless Communications, and Reduced Rank Adaptive Subspace Methods for Detection, Estimation, Synchronization, Tracking, Adaptive Beamforming and Interference Suppression.

Dr. Ge has published 70+ technical papers in International Journals and Conference Proceedings. She currently serves as a member of the IEEE Technical Committee on Sensor Array and Multichannel (SAM) Signal Processing, the Editorial Board of the EURASIP Journal on Wireless Communications and Networking, and the Editorial Board of the IEEE Transactions on Signal Processing. From 1998-2001, she was the Vice Chair and Chair for the Chapter of Communications Society of IEEE North Jersey Section. Since 1999, she has been on the Planning Committee for the Annual Wireless and Optical Communications Conference (WOCC). She was the Chair for the Wireless Program of the WOCC-2003.

About the Talk

Due to the high dimensionality of the measurement data sets as well as the changing dynamics of wireless communication systems, computationally efficient reduced-rank solutions are preferred to their full-rank counterparts in applications such as channel estimation, system synchronization, multi-user detection, and adaptive beam-forming.

This talk introduces the framework of designing reduced-rank multi-user detectors for wireless DS/SS CDMA systems. With the notion of expanding subspaces, we construct the reduced-rank multi-user detectors progressively using the simple structure of filter banks (analysis filters and synthesis filters) – the discrete-time filter vectors contained in the expanding Krylov subspaces. We further provide computationally efficient iterative method for implementing the reduced-rank multi-user detectors along with the geometric interpretations on the filter evolution and error reduction. We prove the existence (sufficient and necessary conditions) of warp convergence in the reduced-rank multi-user detectors for designed CDMA systems, as well as in the adaptive beam-former for multi-sensor array systems. Finally, application examples are presented to demonstrate the enabling capability of the warp convergence in designed communication systems, i.e. the reduced-rank solution delivers the full-rank performance.

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