BCWS Seminar Series

Efficient Non-Coherent Grassmannian MIMO Signalling

by

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Time: Tuesday, March 6, 1:30 - 2:30 pm
Place: Room ME 4356, Mackenzie Building, Carleton University

Abstract: A wireless communication system in which neither the transmitter nor the receiver has access to the channel state information is typically referred to as being non-coherent. In this talk, we consider non-coherent communication systems operating over frequency-flat multiple-input multiple-output (MIMO) Rayleigh block-fading channels. At high signal-to-noise ratios, the capacity achieving distribution for this class of channels corresponds to the isotropic distribution on a compact Grassmann manifold. In order to be able to generate practical noise-resilient constellations on this manifold, one ought to choose a metric that properly accounts for the perturbations caused by the noise. In this talk, we will present a subspace perturbation analysis that will lead us to conclude that an appropriate metric is the chordal Frobenius norm. Using this metric, different techniques for designing Grassmannian constellations are proposed. These techniques result in constellations that possess desirable distance spectra and perform significantly better than currently available designs. In addition, we exploit the subspace perturbation analysis to develop a novel sub-optimum detector. The performance of this detector is comparable to that of the maximum likelihood detector, but it requires considerably less computational effort.

Biography: Ramy Gohary received the B.Eng. (Hons.) degree from Assiut University, Egypt in 1996, the M.Sc. degree from Cairo University, Egypt, in 2000, and the Ph.D. degree from McMaster University, Ontario, Canada in 2006, all in electronics and communications engineering. He received the Natural Sciences and Engineering Research Council visiting fellowship award in 2007. Dr. Gohary was a visiting fellow with the Terrestrial Wireless Systems Branch, Communications Research Centre, Canada. He is currently the project manager of the Carleton-RIM (Research In Motion) research project. His research interests include analysis and design of MIMO wireless communication systems, applications of optimization and geometry in signal processing and communications, information theoretic aspects of multiuser and cooperative communication systems, and applications of iterative detection and decoding techniques in multiple antenna and multiuser systems.