SEMINAR NOTICE

Department of Electrical and Systems Engineering

PERFORMANCE ANALYSIS OF MULTIPLE-INPUT MULTIPLE-OUTPUT SYSTEMS FOR MACROCELL WIRELESS COMMUNICATIONS AND RADAR

by

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Multiple-input multiple-output (MIMO) systems in wireless communications and radar sensing applications have recently attracted much interest. We address statistical analysis of multistatic time-reversal imaging, Cramér-Rao bound analysis on multiple scattering in multistatic point-scatterer estimation, and performance analysis of MIMO systems for wireless communication under macrocell environments.

In radar sensing applications, the MIMO system, or multistatic setup, has been used in computational time-reversal imaging recently. We first present a statistical framework for the fixed-frequency computational time-reversal imaging problem assuming point scatterers in a known background medium. Our statistical measurement models are based on the physical models of the multistatic response matrix, the distorted wave Born approximation and Foldy-Lax multiple scattering models. We develop maximum likelihood (ML) estimators of the locations and scattering potential parameters of the scatterers. Using a simplified single-scatterer model, we interpret a basic time-reversal imaging as a maximum likelihood estimate (MLE) of scattering potential. We analyze the effect of inhomogeneity generated by multiple scattering among point scatterers under the multistatic sensing setup. We derive the Cramer-Rao bounds (CRBs) on location and scattering potential parameters of the scatterers and compare the CRBs for multiple scattering with the reference case without multiple scattering. We show that multiple scattering could significantly improve the estimation performance of the system, and higher order scattering components actually contain much richer information about the scatterers.

In the wireless communications, we develop a semi-deterministic, semi-stochastic channel model for a MIMO system under the macrocell environments with local-to-mobile and local-to-base scatterers. We evaluate the system performance in terms of ergodic capacity, average pairwise error probability (PEP) and show that the capacity, multiplexing, and diversity gains are limited by the number of multipaths around the base station. To improve the performance of the macrocell MIMO systems, we propose using artificial scatterers.

DATE:	Wednesday, April 26, 2006
TIME:	3:00 p.m.
PLACE:	Bryan Hall, Room 305

Research Advisor:
Arye Nehorai

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