SEMINAR NOTICE

Department of Electrical and Systems Engineering

Performance Analysis of the Ormia Ochracea's Coupled Ears and Biologically Inspired Antenna Array Design

PhD Preliminary Research Examination

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Abstract: The female Ormia ochracea, a parasitic fruit fly, locates male crickets very accurately as part of its reproduction. This is unexpected as the distance between its ears is much smaller than the wavelength of the cricket's mating call. This phenomenon has been explained by a mechanical coupling between the ears. In our research, we first analyze the localization accuracy of the female Ormia's coupled ears using a statistical approach. We convert the mechanical coupling model to statistical and analyze the accuracy by computing the Cramér-Rao bound on estimating directions of arrival. We quantitatively demonstrate that the coupling improves the accuracy of direction estimation in the presence of interference and noise.

We then develop a multiple-antenna array system with couplings inspired by the Ormia's ears. We transform the Ormia's response to fit desired radio frequencies, and compute the array response of the biologically inspired multiple-antenna array. For the resulting system, we derive the maximum likelihood estimates of source directions and analyze the performance improvement by computing the error bounds. Moreover, we consider an active transmitting antenna array with coupling, and obtain the array factor of the desired multiple-antenna system for pre-specified radio frequencies. We compute the radiation intensity of this system and analyze its half-power beamwidth, sidelobe levels and directivity of the radiation pattern. We demonstrate the improvement in these performance measures due to the biologically inspired coupling using numerical examples.

Date:	February 26, 2010
Time:	3:00pm
Place:	Bryan 305

Advisor:
Dr. Arye Nehorai

This seminar is in partial fulfillment
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Washington University in St. Louis
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