SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

ESTIMATING ELECTRICAL CONDUCTIVITY TENSORS OF BIOLOGICAL TISSUES USING MICROELECTRODE ARRAYS

PhD Preliminary Research Examination

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Abstract: Finding the electrical conductivity of tissue is important for understanding its structure and functioning. However, the inverse problem of inferring spatial conductivity from data is highly ill-posed and computationally intensive.

We propose a method to solve the inverse problem of inferring tissue conductivity from a set of transmembrane potential and stimuli measurements made by microelectrode arrays (MEA). We first formalize the discrete forward model of transmembrane potential propagation, based on a reaction-diffusion model with an anisotropic inhomogeneous electrical conductivity-tensor field. Then, we develop a novel parallel optimization algorithm for solving the complex inverse problem of estimating the electrical conductivity-tensor field. Specifically, we propose a single-step approximation with a parallel block-relaxation optimization routine that simplifies the joint tensor field estimation problem into a set of computationally tractable subproblems, allowing the use of efficient standard optimization tools. We analyze the performance of our algorithm on numerical examples and real data. We discuss its application to real measurements obtained from smooth-muscle cardiac tissue, using data collected with a high-resolution MEA system.

DATE: Monday, April 8, 2013
TIME: 1:00 p.m.
PLACE: Green Hall, Room 0120

Dissertation advisor:
Dr. Arye Nehorai

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE