SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

FORWARD ELECTROPHYSIOLOGICAL MODELING AND INVERSE PROBLEM FOR UTERINE CONTRACTIONS DURING PREGNANCY

DISSERTATION DEFENSE
By

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Abstract: Uterine contractile dysfunctions during pregnancy is a significant healthcare challenge that imposes heavy medical and financial burdens on both human beings and society. The mechanisms of uterine contractions, however, are still poorly understood. Therefore, it is critical to develop objective methods that help to better characterize uterine contractions. To address this issue, we investigate the forward and inverse problems involved in uterine contractile events based on non-invasive magnetomyography (MMG) measurements. First, we develop a realistic multiscale forward electromagnetic model of human uterine contractions during pregnancy. Our approach aims at computing the abdominal magnetic field that is generated by uterine activities, taking into account current electrophysiological and anatomical knowledge of uterus jointly at the cellular, tissue, and organ levels. Second, we analyze the internal uterine activities from external abdominal MMG measurements by solving the associated inverse problem. We derive a linear approximation model of the sensor-oriented magnetic field measurements with respect to source current dipoles distributed in the myometrium based on a lead-field matrix. This lead-field matrix is analytically computed according to the quasi-static Maxwell's equations. With this model, we estimate the underlying source currents that generate the abdominal magnetic field measurements. Results with both synthetic and real MMG data illustrate that our multiscale forward model is flexible to reproduce the limited-propagation magnetic signature of local contractile activities at term and our inverse estimation manages to capture the initiation and local recruitment of contractile activities during pregnancy.

DATE: **Thursdsay, August 9, 2018**
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