TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Wednesday, 14 November 2018, 4:00 p.m.
Room 617 Wachman Hall

(refreshments and social at 3:45 p.m)

Models and Measurements of Non-Invasive Brain Stimulation effects

by Alexander Opitz
University of Minnesota, Minneapolis

Abstract. In this talk, computational approaches for a more precise estimation of stimulation areas in transcranial magnetic stimulation (TMS) and transcranial electric stimulation (TES) will be presented. Based on realistic MR derived finite element models we simulate the electric field distribution in the brain during TMS/TES. Transcranial electric stimulation (TES) approaches have come to the fore in the brain stimulation community. In particular, the scientific literature for transcranial alternating current stimulation (tACS) and transcranial direct current stimulation (tDCS) has been growing exponentially, with the latter nearly overtaking transcranial magnetic stimulation (TMS) in the past year (per PubMed), reflecting the growing number of potential clinical applications of tDCS and tACS for treating a range of conditions. Despite mounting enthusiasm, the rapid adoption of neuroscientific, clinical or recreational TES raises concerns. Specifically, TES effectiveness in delivering intended currents into the brain is being questioned. In this talk, I will present intracranial measurements of electric fields induced by TES in humans and non-human primates investigating their spatial distribution and temporal characteristics. I will also make a case for the need for in-vivo models compared to ex-vivo or phantom measurements. Further, I will demonstrate how far realistic finite element method models are able to

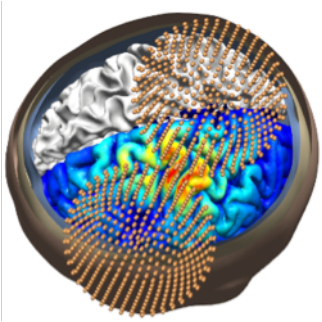

Figure 1: Illustration of the transcranial magnetic stimulation induced electric field (color coded, red color indicates area of highest intensity).

predict the measurement data and highlight key factors needed for accurate modeling results. Based on the presented results, I will discuss novel stimulation approaches that can help to overcome limitations in existing electrical stimulation technologies.

About Alexander Opitz: He is an Assistant Professor in the Department of Biomedical Engineering at the University of Minnesota. His research focuses on developing non-invasive brain stimulation (NIBS) technologies for psychiatric and neurological disorders. Dr. Opitz has a particular interest in the underlying biophysics and physiology of transcranial magnetic stimulation (TMS) and transcranial electric stimulation (TES). He is working on computational models to improve the application of NIBS with regard to interindividual differences in anatomy and function.