TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Wednesday, 9 September 2015, 4:00 p.m.
Room 617 Wachman Hall

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

Connecting neuroscience, numerics and computing: An overview

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Abstract. Neuroscience and medical research has turned into a highly interdisciplinary endeavor. Theoretical approaches have typically been based on analogies rather than physical first principles, thus neglecting various issues that need to be addressed by high resolution-methods. Three-dimensional and detailed morphologies, hybrid-dimensional models and macroscopic, deterministic formulations bring forth systems of coupled, non-linear partial differential equations defined on highly complex computational domains. This is where interdisciplinary neuroscience and medical research will profit from fast numerical solvers, i.e., multi-level and distributed solvers making use of high-performance computing architectures. In this talk we will give an overview of typical model problems arising in theoretical neuroscience and methods for solving the underlying mathematical problems efficiently. Examples include the Poisson-Nernst-Planck equations for electrodiffusion of ions in nerve cells, the cable equation for finite volume discretized neuronal networks and multi-scale simulations at cellular contact points.