Temple University Mathematics Colloquium

Gillian Queisser

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will speak on

Modern techniques in computation-based Neuroscience

ABSTRACT: Understanding the details of signal processing in brain cells on various levels, ranging from the molecular scale to the cellular and network continuum level, is critical when addressing ageing-related pathologies, such as Alzheimer?s or Parkinson?s disease. Current models are typically derived from analogies rather than physical first principles and treat the biological and medical problems with dimension-reduced approaches. In this talk we will discuss advanced numerical methods that are used to numerically compute highly detailed model equations, based on partial and ordinary differential equations, and their application to biological and medical topics. We employ Finite Element and Finite Volume discretization methods and hybrid-element computational grids to handle complex computational domains and solve the resulting linear systems by means of geometric multigrid methods. We will address the issue of hybrid- and high-dimensional problems, exploiting scalable methods for massively parallel computing architectures and grid adaptivity controlled by a novel a posteriori error estimator for Finite Volume discretized equations. Towards the end, we will give an outlook on the potential of these methods in a larger context, such as simulation-driven data interpretation and medical treatment in an emerging field we have termed Virtual Medicine.

Monday, December 1
Lecture at 4:00 pm
Coffee, tea, and refreshments from 3:40 pm
Room 617, Wachman Hall
Department of Mathematics