Cleveland State University
College of Science

COLLOQUIUM

Daniela Calvetti
Professor of Math, Applied Math, and Statistics
Case Western Reserve University

Computationally predictive models of integrated cerebral metabolism, electrophysiology and hemodynamics

Friday January 31st at 3pm in RT 1516

Bio: Dr. Calvetti is the James Wood Willamson Professor in the Department of Mathematics, Applied Mathematics, and Statistics at Case Western Reserve University where she has been a faculty member since 1997. She received her M.S. and PhD degrees in Mathematics from the University of North Carolina at Chapel Hill. She has had many accomplishments including being named a 2015 Simons Foundation Fellow, an NSF MID CAREER Award in 1995, and was Department Chair at CWRU from 2008-2014. Recent work includes the development of theoretical and algorithmic framework for large scale linear systems and eigenproblems, large scale linear ill-posed problems, and quadrature rules.

Abstract: Understanding the energetic requirements of brain cells during resting state and during high neural activity is a very active research area where mathematical models have contributed significantly by providing a context for the interpretation of the experimental results. We recently proposed novel computational predictive models that connect cerebral electrophysiological activity, cellular metabolism and hemodynamic response via a system of double feedback mechanisms based on energy demand and production. In addition to the difficulty of interfacing the modeling paradigms for the different brain functions, many computational challenges had to be addressed, mostly due to the very different characteristic times at which the electrical, metabolic and hemodynamic events occur. Computed experiments with these models for different protocols, that include awake resting state, transitions between resting state and neural activation and ischemic episodes, as well as cortical spreading depression episodes, show that the model predictions are in good agreement with experimental observations.

Refreshments at 2:30pm in RT 1517