2014 Summer Research Experiences (SRE) for Undergraduates and Teachers
Abstract

COMER, M., GO, V., SHAMSHOIAN, J., MCDOWELL, R., ZHAO, X. and H. FINOTTI. Uncovering Cardiac Dynamics Using a Model Independent Technique for Eigenvalue Estimation. National Institute for Mathematical and Biological Synthesis. Knoxville, TN; Campbell County High School, Jacksboro, TN; University of Tennessee, Knoxville, TN; California Polytechnic University, San Luis Obispo, CA; West High School, Knoxville, TN.

Cardiac alternans, a beat-to-beat alternation in action potential duration in cardiac cells, is a harbinger of ventricular fibrillation. Ventricular fibrillation is a fatal arrhythmia and leads to sudden cardiac arrest, which takes the lives of about 300,000 Americans each year. Alternans is characterized by an eigenvalue of the Jacobian approaching -1. Unfortunately, specifying a model to fully describe cardiac dynamics may be impossible. Furthermore, the full state space may not be physically measured. Petrie and Zhao [2012] developed statistical data-driven statistical techniques to estimate dominant eigenvalues and their standard errors by measuring action potent duration values. This work expands the previous technique by introducing random disturbances to the pacing rate. The added disturbance proves to improve the robustness of the technique, rendering it more suitable for experimental analyses, which noises and measurement errors impose challenges to data analysis.