Name:
Sameed Ahmed

Title:
Theory, Computation, and Modeling of Cancerous Systems

Abstract:
This dissertation focuses on three projects. In part one, we derive and implement the compact implicit integration factor method for numerically solving partial differential equations. This method improves the storage and computational cost of solving a class of PDE’s. We extend this method for high order spatial accuracy and inhomogeneous boundary conditions. In part two, we generalize and analyze a mathematical model for the nonlinear growth kinetics of breast cancer stem cells. We generalize this model for an arbitrary number of cellular types and prove criteria for stability. And in part three, we develop a novel mathematical model for the HER2 signaling pathway. This pathway is critical in breast cancer cells. We develop an experimentally integrated model for it and investigate the model to better understand breast cancer treatment.