Brian D. Hong

10968 E Midnight Moon Lane, Tucson, Az, 85747
(520)576-4375

EDUCATION

Ph.D. Student, Applied Mathematics, expected completion 2018
University of Arizona, Tucson, Az
GPA: 3.91
Relevant coursework: principles and methods of applied mathematics (2 semesters), numerical analysis (2 semesters), probability mathematics, perturbation methods, dynamical systems, mechanics of deformable solids, statistics (spring '16)

Master of Science, Applied Mathematics, 2015
University of Arizona, Tucson, Az
GPA: 3.91

Bachelor of Science, Mathematics, 2012
University of Arizona, Tucson, Az
Minor: Chemistry
GPA: 3.72
Relevant coursework: electricity and magnetism, analysis of ordinary differential equations, mathematical principles of numerical analysis (2 semesters), mathematical modeling, applied analysis, theory of complex variables

Bachelor of Arts, Liberal Arts, 2010
Thomas Aquinas College, Santa Paula, Ca
GPA: 3.93

RESEARCH EXPERIENCE

Undergraduate Research 2011-2012
Biochemistry, University of Arizona, Tucson, Az

- While pursuing my undergraduate degree I assisted in developing numerical solutions for mathematically modeling adiponectin (a large protein) from electron microscopy (EM) images. For the most part this involved working with optimization routines and matlab code.

Graduate Research Assistant 2012-2013
ACMS, University of Arizona, Tucson, Az

- While working with the optics department, I developed a model to optimize gain in the VECSEL laser using a Genetic Algorithm optimization routine. Following this, I constructed several finite difference codes mostly for solutions to Maxwell's wave equations (FDTD) with material interactions (drude model, Kerr nonlinearity, etc.) in various coordinate systems (including 2D axisymmetric and 3D cartesian). I used parallel computing (open MPI in C++) to enhance the speed of these codes on a 300 core cluster. Finally, I worked on developing numerical solutions to the time dependent Schrödinger equation (within DFT theory) which included electron-electron, electron-proton, and electron-EM field interactions. This involved advanced numerical techniques such as multigrid solutions to the Poisson equation to calculate electron-electron interactions.

Graduate Research 2013-
Program in Applied Mathematics , University of Arizona, Tucson, Az
Advisor: Timothy Secomb

- My current research is focused on developing methods for modeling cardiac dynamics. I use a variational method to construct the full dynamics of the left heart, but with assumptions that allow the model to be computed in "faster than real" time. More recently I've coded numerical solutions to fluid propagation models for blood flow in the aorta (solutions to reduced Navier-Stokes equations for fluid flow in a compressible tube). My objective is to determine the effects of dynamic afterload (from the reflected pressure wave) on left ventricular function. The most challenging parts of modeling flow in a compressible tube are the boundary conditions, which make use of the eigenvalue decomposition of the advective PDE. Aside from these theoretical models, I'm developing speckle tracking routines for echocardiograms and working with several optimization routines (customized C++ versions of Levenberg-Marquardt, BFGS, and Nelder-Mead) to fit the models to data from patients with various cardiac pathologies.

TEACHING EXPERIENCE

Adjunct Faculty 2010-2012
Pima Community College, Tucson, Az
- Courses: basic mathematics, pre-algebra, algebra I, algebra II

Graduate Teaching Assistant 2013-2015
Department of Mathematics, University of Arizona, Tucson, Az
- Instructor for traditional classroom courses: college algebra, first semester calculus, second semester calculus
- Instructor for online environment courses: college algebra
- Super TA for methods of applied mathematics (part of the graduate core)

COMPUTER SKILLS

Languages & Software: C++ (in visual studio or ubuntu), Matlab, LaTeX, Mathematica, Excel, Word, Powerpoint, Visualization Tool Kit (VTK), ImageJ
- I've written several numerical codes in both C++ and matlab (my latest modeling uses a few thousand lines of C++ code to compute and optimize a model for the left ventricle, left atrium, and lumped circulatory system). In general, I use C++ to develop fast, object oriented numerical codes. When I write a code for the first time I typically write it in matlab (for obvious reasons). I also do most of my visualizations in matlab although I've branched out to VTK (visualization tool kit) in ubuntu to create more professional 3D visualizations. When I need to do lengthy symbolic computations (for example, large symbolic derivatives or symbolic matrix computations) I use mathematica. I use word and powerpoint for routine communication, while I use excel for basic computations and data storage.

AWARDS

National Institute of Health fellow 2015-2016
- Computational and Mathematical Modeling of Biomedical Systems

PUBLICATIONS

1. Time Dependent Regional Myocardial Strains in Patients with Heart Failure with a Preserved Ejection Fraction. Shane P. Smith B.S., Timothy W. Secomb Ph.D., Brian D. Hong B.S., Michael J. Moulton M.D. Submitted to BioMed Research International.
2. Simulation of Left Ventricular Dynamics Using a Low-Order Mathematical Model. Michael J. Moulton, Brian D. Hong and Timothy W. Secomb. In preparation.

CONFERENCE POSTERS

1. Modeling the dynamics of the left ventricle: a low order approach. Brian Hong, Timothy Secomb, Michael Moulton. Presented at "Computational Biofluids in Physiology," May 14-15, 2015.