

Cary Ross Humber

CONTACT INFORMATION Department of Mathematics
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SECURITY CLEARANCE Department of Defense Secret

RESEARCH INTERESTS Control theory, semigroup theory, applied functional analysis, optimization, inverse problems, theoretical and numerical analysis of partial differential equations(PDEs)

EDUCATION **North Carolina State University**, Raleigh, NC USA

Ph.D., Applied Mathematics (expected : May 2011)

- Advisor: Professor Kazufumi Ito
- Area of Study: Applied Analysis/Control & Inverse Problems
- Dissertation Title: *Sparse Reconstruction for Partial Differential Equations*(working)

M.S., Applied Mathematics December 2009

- Advisor: Professor Kazufumi Ito
- Area of Study: Interface Problems and Numerical PDEs
- Thesis Title: *Numerical Methods for Interface Problems*

B.S., Mathematics, May 2005

- Advisor: Professor John Franke
- *Cum Laude*
- Honors Thesis Title: *Chaos, Fractals and their Dependence on Parameters*

EXPERIENCE **Naval Surface Warfare Center**, Panama City, FL USA

Mathematician

September 2009 - present

North Carolina State University, Raleigh, NC USA

Graduate Teaching Assistant

2008-May 2010

- Responsible for lecturing, lesson planning, and grading for mathematics courses.

Center for Research in Scientific Computation at NCSU, Raleigh, NC USA

Research Assistant

2007-May 2010

- Developed numerical techniques for interface problems and problems involving acoustic-structure interactions.

Independent

Private Tutor

2006-2010

- Effective tutoring of high school and college students in mathematics courses.

TEACHING

MA 105 - Mathematics of Finance

- Responsible for grading, tracking attendance and holding office hours for students

MA 107 - PreCalculus

- Responsible for independently teaching the course, including planning lectures and writing tests

MA 401 - Applied Differential Equations II(Undergraduate PDE)

- Assisted research advisor by giving several lectures and helping to prepare the tests

PUBLICATIONS

- Humber, C.R., Ito, K, and Bouton, C “Nonsmooth formulation of the Support Vector Machine”, *submitted*, 2010.
- Humber, C.R. “Nonsmooth Regularization and Control”, *In-Laboratory Independent Research(ILIR) internal report.*, 2010.

PRESENTATIONS

- Naval Undersea Warfare Center, Newport, RI
- In-Laboratory Independent Research(ILIR) End-of-Year Review(October 2010)
- In-Laboratory Independent Research(ILIR) Mid-Year Review(April 2010)
- Office of Naval Research Annual Gathering for Information Integration and Automated Image Understanding(May 2010)

RESEARCH
FUNDING

In-Laboratory Independent Research (ILIR), 2010-2011, \$75k

- Nonsmooth Tikhonov Regularization for State Reconstruction

In-Laboratory Independent Research (ILIR), 2009-2010, \$75k

- Solution of PDEs in Heterogeneous Materials

Research Experience for Early Graduate Students (REG), Summer 2007, \$4k

- High-order finite-difference schemes for Stokes flow

RESEARCH
EXPERIENCE

One way wave equation for Synthetic Aperture Sonar

High Order Finite Difference Scheme on an Overlapped Domain for the Stokes Equations

Model Development and Parameter Estimation for a Uniform Beam Excited by Impact and Voltage Inputs

- Estimated the parameters for a mathematical model of a steel beam excited by piezoelectric patches.

Nonlinear Tracking and Parameter Estimation using Modified Gaussian Filters

- Missile tracking and model parameter estimation using filters based on Gauss-Hermite quadrature.

Optimal Control of Thermal Energy

- Development of the optimal control to maintain positive heat transfer in a physical model.

Analysis of Numerical Methods for PDEs

- Convergence and Stability analysis of computational methods for pdes/systems of pdes.

Validation and Verification(V&V) for a Two Parameter Linear Model

- Use of Monte Carlo Simulations for the V&V of a Spring Model.

Modeling Heat Transfer in a Rod with the Heat Equation

- Estimating model parameters for the heat transfer in copper and aluminum rods.

RESEARCH

GOALS

- To develop both theoretical and computational methods for control and inverse problems governed by PDEs.
- To make strides in theoretical and applied functional analysis.
- To apply cutting edge mathematics to applications in Imaging, Acoustics and general scientific applications.

RESEARCH IN

PROGRESS

- Ill-posed inverse problems resulting from evolution equations
- Nonsmooth regularization and parameter choice rules
- Synthetic Aperture Sonar(SAS) imaging and classification
- Navier-Stokes theory and methods
- Sparse Reconstruction

COURSEWORK

Advanced Functional Analysis & C_0 -semigroup theory, Optimal Control Theory, PDEs, Stochastic PDEs, Lagrange Multiplier Theory & Optimization, Numerical Analysis, Mathematical Modeling, Model Calibration, Linear Algebra, Abstract Algebra, Chaos theory & Fractals

WORKSHOPS

& SEMINARS

- Numerical Methods for Free Boundary and Moving Interface Problems at SAMSI, RTP, NC(2007)
- 2010 Industrial Math/Stat Modeling Workshop for Graduate Students

PROFESSIONAL

- AFFILIATIONS
- Society for Industrial and Applied Mathematics(SIAM)
 - American Mathematical Society(AMS)
 - Mathematics Graduate Student Association at NCSU
 - NCSU SIAM Student Chapter

SERVICE

Mathematics Graduate Student Association

- Third and Fourth Year Representative
- Joint SIAM-SMB Conference on the Life Sciences, 2006**
- Volunteer

COMPUTER
LANGUAGES
& PROGRAMS

Excellent Proficiency

MATLAB, L^AT_EX, MAPLE, COMSOL

Basic Proficiency

CUDA, FORTRAN, HTML, C++