

CURRICULUM VITAE

CHIU-YEN KAO

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EDUCATION

- Ph.D., *Mathematics*, University of California, Los Angeles June 2004
Dissertation: Fast Sweeping Methods for Static Hamilton-Jacobi Equations
Advisor: Stanley Osher
- M.S., *Applied Mechanics*, National Taiwan University June 1999
- B.S., *Mathematics with a minor in Physics*, National Taiwan University June 1997

RESEARCH EXPERIENCE

- *Assistant Professor* (Math, OSU) Sept. 2006 ~ now
Perform over the full range of responsibilities: research, teaching, and service.
- *IMA Industrial Postdoc* (IMA, UMN) Sept. 2004 ~ Aug. 2006
Pursue interdisciplinary mathematical research at the IMA, especially in the areas of inverse problems and computational anatomy.
- *Faculty Mentor* (IPAM, UCLA) Jun. 2004 ~ Aug. 2004
Advise students to do a summer research project in image processing for Areté Associates which is an advanced science and engineering company that provides innovative solutions to the most challenging technical problems faced by the United States (IPAM Research in Industrial Projects for Students (RIPS))
- *Research Assistant / Associate* (UCLA) Apr. 2002 ~ Jun. 2004
Research on the numerical methods for Hamilton-Jacobi equations and Level Set applications on optimization problems
- *Research Assistant* (National Taiwan University) Sept. 1997 ~ Jun. 1999
Research on Percolation theory and its application to random resistor network

Grants

- NSF Grant DMS 0811003: Shape and Topological Optimization on Elliptic Eigenvalue Problems in Inhomogeneous Media (PI) 07/01/08-06/30/11
- Alfred P. Sloan Research Fellowship 09/01/09-08/31/11

TEACHING EXPERIENCE

- *Tenure Track Assistant Professor* (OSU) Sep. 2006 ~
 - Math 865 Topics in Applied Mathematics: Math Biology Spring 2009
 - Math 809 Numerical Method for Partial Differential Equations III Spring 2009
 - Math 807 Numerical Method for Partial Differential Equations I Autumn 2008
 - Math 865 Topics in Applied Mathematics: Image Processing Spring 2008
 - Math 415 Ordinary Differential Equations and Partial Differential Equations Autumn 2007
 - Math 809 Numerical Methods for Partial Differential Equations III Spring 2007
 - Math 572 Linear Algebra with Application II Winter 2007

- Math 571 Linear Algebra with Application I Fall 2006
- **Teaching Assistant /Associate** (UCLA) Apr. 2000 ~ Mar. 2002
- Math 31B Calculus and Analytic Geometry
- Math 32A & 32B Calculus of Several Variables
- Math 61 Introduction to Discrete Structures
- Math 135A & 135B Ordinary Differential Equations
- Math 151B Applied Numerical Methods
- Math 266A Applied Ordinary Differential Equations
- Math 269A Advanced Numerical Analysis
- **Teaching Assistant** (National Taiwan University) Sept. 1998 ~ Jun. 1999
- Course: Applied Partial Differential Equations
- **Teacher** of Li-Wei Liu Math Center Nov. 1993 ~ Jun. 1998

RESEARCH INTERESTS

- Shape Optimization for Elliptic Eigenvalue Problems
- Numerical Methods for Hamilton-Jacobi Equations and Conservation laws
- Mathematical Biology
- Level Set Methods and its Applications
- Numerical Analysis and Scientific Computing

PRESENTATIONS

- The Sixth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, University of Georgia Mar. 2009
A Spectral Method with Window Technique for the Initial Value Problems of Kadomtsev-Petviashvili Equation
- Higher Order Geometric Evolution Equations Theory and Applications from Microfluidics to Image Understanding, IMA, UMN Mar. 2009
A Spectral Method with Window Technique for the Initial Value Problems of Kadomtsev-Petviashvili Equation
- Department of Mathematics, Graz University, Austria Mar. 2009
Shape Optimization for Elliptic Eigenvalue Problem
- Department of Mathematics, The Ohio State University Mar. 2009
Asymptotic Phases in a Cell Differential Model
- Department of Mathematics, Tulane University Feb. 2009
An Efficient Algorithm for Shape Optimization on Elliptic Eigenvalue Problem
- Department of Mathematics, South Carolina University Oct. 2008
Shape Optimization for Elliptic Eigenvalue Problem
- Recent Development for Hyperbolic Equations and its Applications BIRS, Canada Sept. 2008
Cell Cycle Control at the First Restriction Point and its Effect on Tissue Growth
- National Center for Theoretical Sciences, Mathematics Division, Taipei Aug. 2008
Cell Cycle Control at the First Restriction Point and its Effect on Tissue Growth
- SIAM Annual Meeting: San Diego, CA Jul. 2008
Legendre-Transform-Based Fast Sweeping Methods for Static Hamilton-Jacobi Equations
Region-Scalable Active Contour Model for Image Segmentation

- SAMSI Workshop on Random Media Transition Mar. 2008
Shape Optimization for Elliptic Eigenvalue Problems
- MCIAM Conference, Kellogg Center, Michigan State University Mar. 2008
Shape Optimization for Elliptic Eigenvalue Problems
- SIAM Conference Analysis of Partial Differential Equations, Phoenix, Arizona Dec. 2007
Maximization of the Quality Factor of an Optical Resonator
- School of Computational Science, Florida State University Oct. 2007
Region Scalable Fitting Energy for Image Segmentation
- Center for Imaging Science, John Hopkins Sept. 2007
Region Scalable Fitting Energy for Image Segmentation
- NCTS summer short course, Taipei, Taiwan Aug. 2007
Introduction to Image Segmentation
- 6th International Congress on Industrial and Applied Mathematics July. 2007
Inverse Problems Involving Shapes
- Computational and Mathematical Aspects of Materials and Fluids: Iowa State University Apr. 2007
Shape Optimization for eigenvalue problems with applications in photonic crystals and vibrating systems
- Sweeping Seminar: Rice University Apr. 2007
Lax-Friedrichs Fast Sweeping Method & Sweeping Schemes for Visibility Function
- Seminar (Invitation to Research): The Ohio State University Feb. 2007
Mathematics behind Imaging Sciences
- Research Seminar: National Taiwan University, Taiwan Dec. 2006
Implicit Active Contour/Surfaces Driven by Local Binary Fitting Energy
- Numerical Methods for Degenerate Elliptic Equations and Applications: BIRS, Canada Dec. 2006
An adaptive spectral/DG method for a phase-space based level set approach to geometrical optics on curved element
- Seminar: University of California, Irvine Nov. 2006
A Geometric Method of Automatic Extraction of Sulcal Fundi
- Oberwolfach mini-Workshop: Anisotropic Motion Laws: Germany Aug. 2006
The Anisotropic Motion in human brains
- SIAM Annual Meeting: Boston, Massachusetts Jul. 2006
Fast Sweeping Methods for Static Hamilton-Jacobi Equations
- NCTS International Workshop on Scientific Computing: National Taiwan University, Taiwan Jun. 2006
A Geometric Method of Automatic Extraction of Sulcal Fundi
- NCTS International Workshop on Scientific Computing (Tutorial Week): National Taiwan University, Taiwan Jun. 2006
Inverse Problems Involving Shapes
- 2006 IEEE International Symposium on Biomedical Imaging: From Nano to Macro, Virginia Apr. 2006
A Geometric Method of Automatic Extraction of Sulcal Fundi
- Applied Seminars: UCLA, University of Massachusetts at Amherst, University of Colorado at Denver and Health Sciences Center, Southern Methodist University, Illinois Institute of Technology, University of Central Florida, University of Notre Dame, University of Illinois at Chicago, The Ohio State University, Georgia Tech Dec. 2005 ~ Feb. 2006
A Geometric Method of Automatic Extraction of Sulcal Fundi
- SIAM Annual Meeting: New Orleans Jul. 2005

- Maximizing Band Gaps in Two Dimensional Photonic Crystals by Using Level Set Methods*
- Applied Mathematics and Numerical Analysis Seminar, UMN Math Department Oct. 2004
Fast Sweeping Methods for Static Hamilton-Jacobi Equations
 - SIAM Annual Meeting: Portland Jul. 2004
Fast Sweeping Methods for Static Hamilton-Jacobi Equations
 - MURI On-Site Meeting at Stanford University Feb. 2004
Lax-Friedrich Sweeping Methods for Static Hamilton-Jacobi Equations
 - NCTS Dynamical Systems Seminar, Taiwan Dec. 2003
Lax-Friedrich Sweeping Methods for Static Hamilton-Jacobi Equations
 - MURI On-Site Meeting at Stanford University Jan. 2003
Sweeping Methods for Static Hamilton-Jacobi Equations
 - Geometrically Based Motions Reunion Conference at Lake Arrowhead Sept. 2002
Sweeping Methods for Static Hamilton-Jacobi Equations
 - Industrial Mathematics Modeling Workshop at NCSU Jul. 2002
Recognizing Sand Ripple Patterns from Side-scan Sonar Images

PROFESSIONAL EXPERIENCE

- Organizer for Midwest PDE conference, OSU, Nov 2008
- Minisymposium Organizer for SIAM Conference on Analysis of PDE, Phoenix, Arizona, Dec 2007
- Organizer for 2006 NCTS International Workshop on Scientific Computing: National Taiwan University, Taiwan
- Reviewer for Biomedicine and Biotechnology, Communications in Mathematical Sciences, Discrete and Continuous Dynamical Systems B, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Image Processing, International Journal of Biomedical Imaging, Journal of Computational Mathematics, Journal of Computational Physics, and Physics Letters A.

TECHNICAL SKILLS

- Computer Languages: C++, Fortran, Matlab, Maple, Mathematica
- Platforms: Windows, Unix, and Linux

HONORS

- Alfred P. Sloan Research Fellowship 2009-2011
- SIAM News: Geometry, Partial Differential Equations, and the Brain Mar/Apr 2007
- IMA Impacts; NSF Highlights: Mind-Bending Math 2006
- Medical Image Analysis second Best MICCAI Paper Award 2005
- Teaching and Research Assistantships (UCLA) Sept. 1999 ~ Jun. 2004
- Teaching and Research Assistantships (National Taiwan University) Sept. 1997 ~ Jun. 1999
- The Ministry of Education Graduate Scholarship (Taiwan) Sept. 1997 ~ Jun. 1999
- Scholarship for Gifted Senior High School Students Studying Mathematics and Natural Science (Taiwan) Sept. 1993 ~ Jun. 1997
- The Presidential Award (Taiwan) Jun. 1996

MEMBERSHIPS

- Society for Industrial and Applied Mathematics

PUBLICATIONS

- Legendre-Transform-Based Fast Sweeping Methods for Static Hamilton-Jacobi Equations on Triangulated Meshes by Chiu Yen Kao, Stanley Osher and Jianliang Qian, *Journal of Computational Physics*, 227(24), Pages 209-225, 2008
- Properties of a Level Set Algorithm for the Visibility Problems by Chiu-Yen Kao and Yen-His Tsai, *UCLA Math CAM Reports 06-04, Journal of Scientific Computing*, 35(2), Pages 170-191, 2008
- Minimization of Region-Scalable Fitting Energy for Image Segmentation by Chunming Li, Chiu-Yen Kao, John C. Gore, and Zhaohua Ding, *IEEE Transactions on Image Processing*, 17(10), 2008
- Principle Eigenvalue for an Elliptic Problem with Indefinite Weight on Cylindrical Domains by Chiu-Yen Kao, Yuan Lou and Eiji Yanagida, *Mathematical Biosciences and Engineering* 5(2), Pages 315-335, 2008
- Maximization of the Quality Factor of an Optical Resonator by Chiu-Yen Kao and Fadil Santosa, *Wave Motion* 45(4), Pages 412-427, 2008
- Brain MR Image Segmentation Using Local and Global Intensity Fitting Active Contours/Surfaces by Li Wang, Chunming Li, Quansen Sun, Deshen Xia, and Chiu-Yen Kao (*MICCAI*, 384-392, 2008)
- Brain MR Image Segmentation by Minimizing Scalable Neighborhood Intensity Fitting Energy: A Multiphase Level Set Approach by Chunming Li, Li Wang, Chiu-Yen Kao, John C. Gore, and Zhaohua Ding (*ISMRM 2008*)
- Incorporating Topological Derivatives into Shape Derivatives Based Level Set Method by Lin He, Chiu-Yen Kao and Stanley Osher, *UCLA Math CAM Report 06-44 (Journal of Computational Physics*, 225(1), Pages 891-909, 2007)
- A Geometric Method for Automatic Extraction of Sulcal Fundi by Chiu-Yen Kao, Michael Hofer, Guillermo Sapiro, Josh Stern, and David Rottenberg, *IMA preprints 2078, (IEEE Transactions on Medical Imaging*, 26(4), Pages 530-540, 2007)
- Implicit Active Contour/Surfaces Driven by Local Binary Fitting Energy by Chunming Li, Chiu-Yen Kao, and Zhaohua Ding (*IEEE CVPR*, 383014, 2007)
- A Geometric Method for Automatic Extraction of Sulcal Fundi by Chiu-Yen Kao, Michael Hofer, Guillermo Sapiro, Josh Stern, and David Rottenberg (*ISBI 2006: Pages 1168-1171*)
- Maximizing Band Gaps in Two Dimensional Photonic Crystals by Using Level Set Methods by Chiu-Yen Kao, Stanley Osher, and Eli Yablonovitch *UCLA Math CAM Reports 05-05 (Applied Physics B: Lasers and Optics*, 81, Pages 235-244, 2005)
- White Matter Tractography by Anisotropic Wavefront Evolution and Diffusion Tensor Imaging by Marcel Jackowski, Chiu Yen Kao, Maolin Qiu, R. Todd Constable, and Lawrence H. Staib *UCLA Math CAM Reports 05-03 (Medical Image Analysis*, 9, Pages 427-440, 2005)
- The Lax-Friedrichs Sweeping Method for Optimal Control Problems in Continuous and Hybrid Dynamics by Chiu Yen Kao, Carmeliza Navasca, and Stanley Osher, *UCLA Math CAM Reports 04-24 (Journal of Nonlinear Analysis*, 63, Pages e1561-e1572, 2005)
- Fast Sweeping Methods for Hamilton-Jacobi Equations by Chiu Yen Kao, Stanley Osher and Yen-His Tsai, *UCLA Math CAM Reports 02-66 (SIAM Numerical Analysis*, 42, Pages 2612-2632, 2005)
- Estimation of Anatomical Connectivity by Anisotropic Front Propagation and Diffusion Tensor imaging by Marcel Jackowski, Chiu Yen Kao, Maolin Qiu, R. Todd Constable, and Lawrence H. Staib (*MICCAI (2) 2004: Pages 663-670*)

- Lax-Friedrichs Sweeping Scheme for Static Hamilton-Jacobi Equations by Chiu Yen Kao, Stanley Osher and Jianliang Qian, *UCLA Math CAM Report 03-38, (Journal of Computational Physics, 196(1), Pages 367-391,2004)*

Under Review and Preparation

- Asymptotic Phases in a Cell Differentiation Model by Avner Friedman, Chiu-Yen Kao, Chih-Wen Shih (accepted by Journal of Differential Equations)
- Active Contours Driven by Local and Global Intensity Fitting Energy with Application to Brain MR Image Segmentation by Li Wang, Chunming Li, Quansen Sun, Deshen Xia, and Chiu-Yen Kao (*accepted by Journal of Computerized Medical Imaging and Graphics*)
- Modeling Oxygen Transport in Surgically Reconstructed Tissues by Anatasios Matzavinou, Chiu-Yen Kao, J. Edward F. Green, Alok Sutradhar, Michael Miller, and Avner Friedman (*accepted to Proceedings of the National Academy of Sciences*)
- Cell Cycle Control at the First Restriction Point and its Effect on Tissue Growth by Avner Friedman, Bei Hu and Chiu-Yen Kao (*submitted to Journal of Mathematical Biology*)
- Semi-Automatic Extraction Algorithm of Ciliary Body from Visante Images by Chiu-Yen Kao, Kathryn Richdale, Loraine Sinnott and Melissa Bailey (*submitted to Journal of Ophthalmic and Physiological Optics*)
- Two Species Competition Models with Different Dispersal Strategy by Chiu-Yen Kao, Yuan Lou, and Wenxian Shen (*submitted to Discrete and Continuous Dynamical Systems*)
- The Development of Gyrfication in Childhood and Adolescence by Tonya White, Shu Su, Marcus Schmidt, Chiu-Yen Kao, and Guillermo Sapiro (*submitted to Brain and Cognition*)
- Geometric Computation of Human Gyrfication Indexes from Magnetic Resonance Images by Shu Su, Tonya White, Marcus Schmidt, Chiu-Yen Kao, and Guillermo Sapiro (*submitted to Human Brain Mapping*)
- An Efficient Algorithm for Shape Optimization on Elliptic Eigenvalue Problems by Chiu-Yen Kao (*In preparation*)
- Initial Value Problems of the KP Equation for V-Shape Initial Value Waves by Chiu-Yen Kao and Yuji Kodama (*In preparation*)
- A Moving Boundary Model Motivated by Electric Breakdown: II. Initial Value Problem by Chiu-Yen Kao, Fabian Brau, Ute Ebert, Lothar Schaefer and Saleh Tanveer (*In preparation*)
- Numerical Methods for Capturing Non-classical Shock Solutions of Modified Buckley-Leverett Equation by Ying Wang and Chiu-Yen Kao (*In preparation*)

REFERENCES

- Professor Stanley Osher, Department of Mathematics, UCLA
E-mail: sjo@math.ucla.edu (thesis advisor)
- Professor Fadil Santosa, Department of Mathematics, UMN
E-mail: santosa@ima.umn.edu (mentor in IMA)
- Professor Guillermo Sapiro, Department of Electrical and Computer Engineering, UMN
E-mail: guille@ece.umn.edu
- Professor Eli Yablonovitch, Department of Electrical Engineering and Computer Sciences, UC Berkeley
E-mail: eliy@eecs.berkeley.edu

TEACHING REFERENCE

- Professor Hailiang Liu, Department of Mathematics, Iowa State University
E-mail: hliu@iastate.edu