

Charles H. Margraves
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Research Interest

My interests include visualizing and analyzing thermal, fluid, and bio-processes at micro/nano scale levels, using a variety of microscopy techniques (Fluorescence, TIRFM, DICM, IRCM, etc.).

Education

Ph.D. Mechanical Engineering, University of Tennessee at Knoxville, Knoxville, TN (In Progress)
MS Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA, 2003
BS Engineering, University of Tennessee at Chattanooga, Chattanooga, TN, 1996

Academic Experience

Graduate Research Assistant, Department of Mechanical, Aerospace, and Biomedical Engineering, University of Tennessee, 2004-present:

- Conducted experiments to examine the normal and tangential hindered Brownian diffusion coefficients of fluorescent polystyrene nano-spheres near a surface using Total Internal Reflection Fluorescent Microscopy (TIRFM).
- Examined the motion of NAG-1 vesicles inside colorectal cancer cells. This work included cell culturing, transfection with Green Fluorescent Protein (GFP), and imaging using multiple microscopy techniques.
- Developed several Digital Image Processing (DIP) codes to 1) track nano and bio-particles using TIRFM images, 2) measure the cell-coverage area on a bio-sensor using DICM images and 3) calculate the focal contact coverage area using IRCM images.

Instructor, Department of Mechanical, Aerospace, and Biomedical Engineering, University of Tennessee, 2007

- Taught junior level Fluid Mechanics course for Mechanical, Aerospace, and Biomedical Engineering (MABE) department.

Graduate Teaching Assistant, Engineering Fundamentals Division, University of Tennessee, 2003-2005:

- Helped teach freshman level engineering course covering the following subjects: Statics, Dynamics, Matlab/Programming, and Mechanical Desktop/CAD.
- Responsible for recitation, using some of the latest educational teaching software, grading of homework sets and tests, and providing tutoring sessions for students outside of class.

Professional Experience

CFD Analyst, Stone Engineering Company, Huntsville, AL, 1998-2003:

- Helped in design, construction, testing, and analysis of both a Phase I and Phase II small business innovative research (SBIR) project examining performance issues for a gel rocket motor.
- Conducted CFD analysis on several solid and liquid rocket motors.
- Provided analytical support for multiple missile defense systems. Analysis included grain regression studies, examination of localized heating issues, design changes needed to eliminate combustion instability, and overall performance of motors.

Production Engineer, Denso Manufacturing, Maryville, TN, 1996-1998

- Responsible for creating Process Failure Modes Effect Analysis (PFMEA) to examine potential problems with new products.
- Project leader for design and installation of powder coating line. Included choosing a supplier, providing product specifications, and overseeing installation.
- Examined quality and cost effectiveness of new cutting tools using standard statistical tools on clutch machining line.

Technical Skills

- Worked with several computational fluid dynamics and finite element software packages including Fluent and Cosmos/M.
- Hands on experience in multiple microscopy systems (TIRF, IRM, DICM, Fluorescent).
- Developed software to examine and analyze digital images including particle tracking velocimetry (PTV).
- Significant experience programming in FORTRAN and MATLAB environments.

Teaching Interests

Fluid Mechanics, Gas Dynamics, Heat Transfer, Thermodynamics, Statics, Dynamics, Optics, Matlab and/or FORTRAN Programming.

Publications and Presentations

- C. H. Margraves, C. K. Choi, K. D. Kihm “Measurements of the minimum elevation of nanoparticles by 3-D nanoscale-PTV using ratiometric evanescent wave imaging”, *Experiments in Fluids*, Volume 41, Number 2, August 2006.
- C. K. Choi, C.H. Margraves, and K. D. Kihm, “Variabilities Affecting Near-Wall Diffusion of Nano-Particles Using 3D-TIRFM (Total Internal Reflection Fluorescent Microscopy), 6th International Symposium on Particle Image Velocimetry, Pasadena, California, September 21-23, 2005.
- C. K. Choi, C.H. Margraves, and K. D. Kihm, “Examination of Near-wall hindered Brownian diffusion of nanoparticles: Comparison to theories by Brenner (1961) and Goldman et al. (1967)”, *Physics of Fluids*, Volume 19, Number 10, October, 2007.
- Chang K. Choi, Anthony E. English, Kenneth D. Kihm, and Charles H. Margraves, “Simultaneous dynamic optical and electrical properties of endothelial cell attachment on indium tin oxide bioelectrodes”, *Journal of Biomedical Optics*, Volume 12, Number 6, 064028, 2007.
- Charles H. Margraves, Chang K. Choi, Kenneth D. Kihm, Anthony English, Seong H. Lee, Maria Cekanova, and Seung J. Baek, “Quantitative imaging of Nanoparticles and intracellular vesicle trafficking using total internal reflection fluorescent microscopy (TIRFM)”, Poster Session ASME 2007 Summer Bioengineering Conference.
- Chang K. Choi, Chuck H. Margraves, Anthony E. English, and Kenneth D. Kihm, “Opto-Electric Cellular Biosensor Using Optically Transparent Indium Tin Oxide (ITO) Electrodes,” *Sensors*, (Submitted).
- Anthony E. English, Chang K. Choi, Charles H. Margraves, and Kenneth D. Kihm, “A statistical geometric analysis of endothelial cell attachment to electro-optic bioelectrodes,” *Biomedical Signal Processing and Control* (Submitted).