ADRIAN M. KOPACZ

Graduate Student

Northwestern University
Department of Mechanical Engineering
2145 Sheridan Road, A315
Evanston, IL 60208-3111

(708) 299-4638
a-kopacz@northwestern.edu

EDUCATION:

NORTHWESTERN UNIVERSITY, Evanston, Illinois
Pursuing Ph.D. in Mechanical Engineering — Exp. 2010
Course highlights: Adv. Topics in Comp. Fluid Dynamics, Micro/Nanoscale Fluid Dynamics, Mechanics Continua, Advanced Finite Element Method (FEM) Linear and Non-Linear — GPA: (3.72/4.0)

NORTHWESTERN UNIVERSITY, Evanston, Illinois
M.S. in Mechanical Engineering — June 2008
Thesis: *Computational simulation of focal adhesion in vascular endothelial cells*
Course highlights: Simulation Techniques, IGERT Nano Mechanics & Materials I/II, Parallel Computing (MPICH2), Cardiovascular Biology and Engineering — GPA: (3.59/4.0)

NORTHWESTERN UNIVERSITY, Evanston, Illinois
B.S. in Mechanical Engineering — June 2005
Course highlights: Fluid Mechanics, Material Science, Thermodynamics, Heat Transfer, Material Properties, Stress Analysis, Control Systems, and Numerical Methods for Engineers — GPA: (3.24/4.0)

RESEARCH INTERESTS:

My general research interest encompasses multiscale methods and simulations. I have an enormous interest in various aspects of nanotechnology inspired by biology, medicine and engineering. In particular, developing and improving experimentally validated predictive science-based modeling and simulation efforts to elucidate and characterize molecular modulation of cell function. I am also interested in developing and optimizing computational methods using parallel programming. In the future, I hope to be able to focus on developing integrated multiscale multiprocessor software analysis modules competent of evaluating nano- and micro- fluidic systems, optical-electronic devices, implantable sensors, smart medicines, microscopic machines and other biomedical devices that can be later integrated into commercial software providing powerful methodologies.

HONORS & ACTIVITIES:

- Active member and a web site designer of Northwestern Univ. Polish American Student Alliance, 2001-2005.
- Northwestern Univ. Commuters Club: Co-Webmaster and an active member, 2001-2005
- Active web site designer/developer of Ruth Page Center for the Arts, Chicago Illinois, 2001-Present.
- 3rd Place Microsoft sponsored .NET Development Contest Winner in Computer Science, Northwestern Univ., May 2002.
- 2nd Place Microsoft sponsored .NET Development Contest Winner in Computer Science, Northwestern Univ., May 2003.

- National Science Foundation Summer Institute on Nano-Mechanics and Materials webmaster, 2004 – present.
- Completed short course on Multiscale Modeling and Simulation of Nano-Mechanics and Materials, 2004.
- Completed short course on Nanoscale Mechanics, Bio-Inspired Hierarchical Structures, and Potential Applications, 2005.
- Completed course work with Honors, Robert R. McCormick School of Engineering & Applied Science, Northwestern Univ., 2005.

GRANTS:

- Recipient of the NSF Research Grant, REU Supplement for Modeling of Nanoscale Systems and Processes, Nov. 2003
- Recipient of the Northwestern Summer Research Grant, Nov. 2004
- Recipient of the Walter P. Murphy Fellowship, 2005-2007

PUBLISHED WORK:

- Albert C. To, Wing Kam Liu, **Adrian Kopacz**, "A finite temperature continuum theory based on interatomic potential in crystalline solids," *Computational Mechanics*, Accepted, 2008.

- **Adrian Marcin Kopacz**, Wing Kam Liu, Shu Q. Liu, "Simulation and prediction of endothelial cell adhesion modulated by molecular engineering," *Computer Methods in Applied Mechanics and Engineering*, 197(25-28), 2340-2352, 2008.

- Yaling Liu, Wing Kam Liu, Ted Belytschko, Neelesh Patankar, Albert C. To, **Adrian Kopacz**, Jae-Hyun Chung, "Immersed electrokinetic finite element method," *International Journal for Numerical Methods in Engineering*, 71:379-405, 2007.

CONFERENCE, SEMINARS AND WORKSHOP PRESENTATIONS:

- NSC-NSF Workshop: "Simulation and Prediction in Vascular Systems - Employing Bioregenerative Engineering in Human Pathology Impediment," National Cheng Kung University of Tainan, Tainan, Taiwan, February 18 - 22, 2008.

- EPSRI Seminar: "Fuego Wildfire Modeling," Sandia National Laboratories, Livermore, CA, September 12, 2007.

- NECIS Seminar: "The Immersed Finite Element Method for Incompressible Flow Computations," Sandia National Laboratories, Livermore, CA, August 22, 2006.

- LANS Seminar: "DFT-Based Nanostructure Investigation," Argonne National Laboratory, Argonne, IL, August 10, 2005.

EXPERIENCE:

Sandia National Laboratories,
Thermal/Fluid Science and Engineering Department (ORG:08757) Livermore, CA
Enabling & Predictive Simulation Research Institute at Sandia (EPSRI) Intern Summer 2007
Wildfire modeling via Fuego coupled with Lagrangian reacting particles in turbulent combustion
Mentor: Greg Wagner
Description: Most of the effort was devoted to implementing wildland models, performing stability analysis of the explicit Lagrangian particle scheme and its verification addressed through a benchmark comparison to the implementation of the porous media flow capability in SIERRA/Fuego and to the analytical solution of Darcy's law. Based on these findings, a new scheme was proposed allowing for particle ODE equations to evolve in time and space, namely, integration being performed through a combination of subcycling and iteration along with a more computationally expansive fluid velocity interpolation at each Lagrangian particle position.

Mechanical Engineering Department, Northwestern University Evanston, IL
Research/Teaching Assistant (Selected Topics in Mechanical Engineering) Sept 06-June 07
Multiscale simulations
Advisor: Wing Kam Liu
Description: Provided lectures and conducted instructional laboratory sessions to teach graduate students on how to use classical molecular dynamics code LAMMPS, developed at Sandia National Laboratories, which stands for Large-scale Atomic/Molecular Massively Parallel Simulator. Course material included usage of the LAMMPS code on a single-processor machine and in parallel via message-passing and how to modify or extend the code with new functionality.

Sandia National Laboratories, Mechanics of Materials Department (ORG:08776) Livermore, CA
The Nanoscience, Engineering, and Computation Institute at Sandia (NECIS) Intern Summer 2006
Implementation of the immersed finite element method for incompressible flow computations via TAHOE
Mentors: Thao Nguyen (Vicky), Greg Wagner
Description: Most of the effort had been devoted to implement and verify a fluid solver within TAHOE's infrastructure. In particular, the stabilized formulation of the nonlinear Navier-Stokes equations for incompressible flows had been implemented via a mixed integration scheme. Numerical oscillations in both the velocity and pressure fields at the boundaries had been treated with the streamline-upwind/Petrov-Galerkin (SUPG) and the pressure-stabilizing /Petrov-Galerkin (PSPG) methods.

Mechanical Engineering Department, Northwestern University Evanston, IL
Research Assistant Nov. 2005-06
Parallelization and optimization of the immersed finite element method (IFEM)
Advisor: Wing Kam Liu
Description: The goal of this project is to parallelize and optimize both the fluid and solid solver in order to decrease the computation time and allow for study of larger systems. For improved computational efficiency, GMRES iterative scheme was employed where the residual is computed based on the matrix-free techniques.

Argonne National Laboratory, Mathematics & Computer Science Division Argonne, IL
DOE Science Undergraduate Laboratory Intern (SULI) Summer 2005
Density Functional Theory-Based Nanostructure Investigation
Mentors: Mihai Anitescu, Dan Negrut
Description: Joined in the early stage of the development of software for the investigation of chemical and mechanical properties of nanostructures. The method formulates a two-step approach

(electronic/ionic problem) to compute the electronic density distribution in and around a nanostructure and then the displacement of its nuclei.

Mechanical Engineering Department, Northwestern University Evanston, IL
Research/Teaching Assistant (IGERT Nano Mechanics & Materials I/II) June 03-05
Advisor: Wing Kam Liu
Research Area: Nanofluidics of Nanotubes

- Modeled 3D He fluid flow (continuum) past a Nanotube - Fortran90/C/C++ (benchmark using ALCMD)
- Modeled 2D He fluid flow (molecules) past a Nanotube - MATLAB (IGERT ME317/ME318 Teaching Tool)
- Conducted instructional laboratory sessions and provided help to undergraduates and graduates by showing them how to apply their skills and knowledge about molecular dynamics using MATLAB and MATHEMATICA
- Developed extensive codes in MATLAB to aid students in understanding general concepts and help illustrate the phenomena of molecular dynamics
- Aided in projects involving boundary element methods, fluid-structure interactions, coupling of particle models and continuum models, molecular dynamics (ALCMD), finite element/continuum methods (TAHOE), and parallel computing via MPICH

Knowledge Dynamics Evanston, IL
Software Developer Intern Summer 2004

- Designed and developed KDCalc Excel parser using managed C++. KDCalc is a runtime calculation engine, which converts Excel Spreadsheets into high-speed, lightweight components for Java and .NET platforms. KDCalc is used by large corporations ranging from banks to academic institutions around the world.
- Developed modules for Hipergate 2.0. Hipergate is an open source CRM suite comprised of Groupware, Intranet, Project and Content Management
- Designed/Developed applications using Java, JavaScript, DHTML, SQL, XML, C#, ASP.NET, Visual C++/Basic

COMPUTER SKILLS:

Languages: Assembly, C/C++, FORTRAN 95/2003, VB, MATLAB
CAD: Unigrahics NX(Modelling/Assembly/Drafting/CAM), Pro/Engineer, Solidworks, AutoCAD
FEA: Pro/Mechanica, ANSYS10 Workbench, Abaqus, Ensight, ParaView, CUBIT
Operating Systems: DOS, Windows 95/NT/2000/XP/2K3, OS X, SGI-Unix, Red Hat & Debian Linux
Software: Office 2K, VS 6.0 and .NET, TotalView, Rational Rose, SourceSafe, Doxygen, CVS, Macromedia Dreamweaver/Flash/Fireworks, JBuilder, Eclipse, MS IIS v5.0, Apache2/TomCat, MySQL, SQL Server, PostgreSQL, MATLAB, MAPLE, Mathematica, Tecplot, Adobe Photoshop 6.0, Paint Shop Pro