

Kaushik Dayal
Assistant Professor of Mechanics, Materials and Computing
Civil and Environmental Engineering, Carnegie Mellon University

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Education

Ph.D. in Mechanical Engineering and minor in Materials Science, 2007
M.S. in Aeronautics, 2001
California Institute of Technology
B.Tech. in Naval Architecture, 2000
Indian Institute of Technology Madras (Chennai)

Professional Appointments

Assistant Professor, Jan 2008 – present
Civil and Environmental Engineering, Carnegie Mellon University
Postdoctoral Researcher, Jul 2006 – Dec 2007
Aerospace Engineering and Mechanics, University of Minnesota

Visiting Positions

Visiting Researcher, May – Aug 2012
Hausdorff Research Institute for Mathematics, University of Bonn

Professional Recognition and Awards

Faculty Early Career Development (CAREER) Award, 2012
Awarded by the National Science Foundation
Young Investigator Award, 2012
Awarded by the Air Force Office of Scientific Research
Acta Materialia Student Award, 2008
Awarded by the Acta Materialia Journal
Supercomputing Institute Research Scholarship, 2006 – 2007 and renewed 2007 – 2008
Awarded by the University of Minnesota Supercomputing Institute
Russell R. Vought Graduate Fellowship, 2000 – 2001
Awarded by the Graduate Aeronautical Laboratories, California Institute of Technology

Journal Articles

Preprints/offprints are available at <http://www.ce.cmu.edu/~kdayal/Publications.html>

- *Real-Space Phase-Field Simulation of Piezoresponse Force Microscopy Accounting for Stray Electric Fields*. Lun Yang and Kaushik Dayal. Submitted.
- *Continuum Mechanics of Line Defects in Liquid Crystals and Liquid Crystal Elastomers*. Amit Acharya and Kaushik Dayal. Submitted.
- *Microstructure and Stray Electric Fields at Surface Cracks in Ferroelectrics*. Lun Yang and Kaushik Dayal. To appear in Int. J. Fract.

- *Free Surface Domain Nucleation in a Ferroelectric under an Electrically Charged Tip*. Lun Yang and Kaushik Dayal. J. Appl. Phys., 111:014106, 2012.
- *Design of viscometers corresponding to a universal molecular simulation method*. Kaushik Dayal and Richard D. James. J. Fluid Mech., 691:461–486, 2012.
- *A Completely Iterative Method for the Infinite Domain Electrostatic Problem with Nonlinear Dielectric Media*. Lun Yang and Kaushik Dayal. J. Comput. Phys., 230:7821–7829, 2011.
- *Effect of Lattice Orientation, Surface Modulation, and Applied Fields on Free-Surface Domain Microstructure in Ferroelectrics*. Lun Yang and Kaushik Dayal. Acta Mater., 59:6594–6603, 2011.
- *Symmetry-Adapted Non-Equilibrium Molecular Dynamics of Chiral Carbon Nanotubes under Tensile Loading*. Amin Aghaei and Kaushik Dayal. J. Appl. Phys., 109:123501, 2011.
- *Linear Instability Signals the Initiation of Motion of a Twin Plane under Load*. Chang-Tsan Lu and Kaushik Dayal. Phil. Mag. Lett., 91:264, 2011.
- *Formulation of phase-field energies for microstructure in complex crystal structures*. Lun Yang and Kaushik Dayal. Appl. Phys. Lett., 96:081916, 2010.
- *Nonequilibrium molecular dynamics for bulk materials and nanostructures*. Kaushik Dayal and Richard D. James. J. Mech. Phys. Solids, 58:145–163, 2010.
- *Active tuning of photonic device characteristics during operation by ferroelectric domain switching*. Kaushik Dayal and Kaushik Bhattacharya. J. Appl. Phys., 102:064102, 2007.
- *A real-space, non-local, phase-field model of ferroelectric domain patterns in complex geometries*. Kaushik Dayal and Kaushik Bhattacharya. Acta Mater., 55:1907–1917, 2007.
- **Recognized for the Acta Materialia Student Award, 2008.**
- *Graded ferroelectric capacitors with robust temperature characteristics*. Mohamed El-Naggar, Kaushik Dayal, David Goodwin, and Kaushik Bhattacharya. J. Appl. Phys., 100:114115, 2006.
- *Kinetics of phase boundaries in the peridynamic formulation of continuum mechanics*. Kaushik Dayal and Kaushik Bhattacharya. J. Mech. Phys. Solids, 54:1811–1842, 2006.

Patents

Ferroelectric nanophotonic devices. Harry Atwater, Kaushik Bhattacharya, Kaushik Dayal, Matthew Dicken, Demetri Psaltis, Axel Scherer, and Guruswami Ravichandran, US Patent 7,346,248 B2. Issued Mar 18, 2008.

Invited Workshop Presentations and Seminars

Multiscale Atomistics for Defects in Electronic Materials at the Joint Materials/Solid Mechanics Seminar, Brown University, February 2012.

Predictive Modeling of Thin-Film Multiferroic Devices with Defects and Microstructure in Complex Settings at the Army Research Laboratory Workshop on Complex Oxide and Multiferroic Thin Film Materials Science, Technologies, and Applications, January 2012.

Multiscale Atomistics for Defects in Electronic Materials at the Materials Interest Group Seminar in the Department of Mechanical Science and Engineering, University of Illinois, November 2011.

Multiscale methods for Complex Crystals and Nano-/Bio-structures at the Mechanical Engineering and Applied Mechanics Department Seminar, University of Pennsylvania, October 2011.

Multiscale Atomistic Simulation of Ferroelectrics and Carbon Nanotubes at the Mechanical Engineering Seminar, Indian Institute of Science, August 2011.

Atomistic Simulation of Ferroelectrics and Carbon Nanotubes at the Laboratori de Calcul Numeric Seminar, Universitat Politecnica de Catalunya, June 2011.

Non-Equilibrium Deformations in Phase-Transforming Materials and Nanostructures at the Mechanical Engineering Department Seminar, University of Houston, March 2011.

Non-Equilibrium Deformations in Phase-Transforming Materials and Nanostructures at the Civil Engineering Department Seminar, Johns Hopkins University, March 2011.

Multiscale Mechanics in Materials with Long-Range Electromagnetic Forces at the Computational and Information Sciences Directorate Seminar, U.S. Army Research Laboratory, March 2011.

Non-Equilibrium Deformations in Phase-Transforming Materials and Nanostructures at the Mechanical Engineering Department Seminar, Ohio State University, March 2011.

Non-Equilibrium Deformations in Phase-Transforming Materials and Nanostructures at the Mechanical Engineering Department Seminar, University of Michigan, November 2010.

Non-Equilibrium Deformations in Phase-Transforming Materials and Nanostructures at the Center for Nonlinear Studies Seminar, Los Alamos National Laboratory, September 2010.

Nonlocal Models of Microstructure in Active Materials at the Laboratoire de Physique et Mecanique des Materiaux Seminar, University of Metz, June 2010.

Nucleation and Kinetics of Phase Boundaries in Peridynamics at the European Symposium on Martensitic Transformations, September 2009.

Characterizing Peridynamics for the Dynamic Motion of Martensitic Interfaces at the Workshop on PDE and Materials, Mathematisches Forschungsinstitut Oberwolfach, September 2009.

Computing Microstructure in Ferroelectrics Specimens with Complex Geometries at the Palffy-Muhoray Group Seminar in the Liquid Crystal Institute, Kent State University, May 2009.

Mechanics of Active Materials with Long-Range Interactions at the Computational and Applied Mathematics Colloquium in the Department of Mathematics, Pennsylvania State University, May 2009.

em Nucleation and Kinetics of Phase Boundaries in Peridynamics at the Center for Multiscale Modeling for Engineering Materials Seminar, Carnegie Mellon University, May 2008.

Introduction/Overview of the Peridynamics Method at the Solid Mechanics Seminar in the Department of Aerospace Engineering and Mechanics, University of Minnesota, November 2007.

Mechanics of Active Materials at Small Scales at the Civil and Environmental Engineering Department Seminar, Carnegie Mellon University, October 2006.

Evolution of Phase Boundaries Using the Nonlocal Peridynamic Theory at the Solid Mechanics Seminar in the Department of Aerospace Engineering and Mechanics, University of Minnesota, October 2006.

Mechanics of Active Materials at Small Scales at the Mechanical Engineering Department Seminar, Massachusetts Institute of Technology, April 2006.

Doctoral Students

Abraham Lu, 2008 – present

Jason Marshall, 2009 – present

Best Poster Award at 2011 US National Congress on Computational Mechanics

Northrop-Grumman Graduate Fellowship Award, 2011 – 2012

Amin Aghaei, 2009 – present

Hossein Pourmatin (jointly advised with A. Acharya), 2010 – present

Likun Tan (jointly advised with A. Acharya and L. Soibelman), 2008 – present
Ellegood Fellowship, 2008 – 2012

————— Graduated —————

Lun Yang, 2008 – 2012

Deans Fellowship, 2008 – 2009

Liang Ji-Dian Fellowship, 2011 – 2012

Thesis: Real Space Phase Field Simulations of Ferroelectric Materials

Undergraduate Thesis Students

Michael Panzitta, Carnegie Institute of Technology Honors Thesis, 2010 – 2011

H. A. Thomas Scholarship Award, 2011

Recent Professional and University Service

Co-organizer of symposiums on *Mechanics of Phase Transforming and Multifunctional Materials* at the Society of Engineering Science Annual Meetings of 2009, 2011, and 2012.

Member of the Technical Program Committee; Co-organizer of the *Prager Medal Symposium in Honor of Richard James: Using Mechanics to Discover New Materials*; and Co-organizer of the *Symposium on Multiscale Modeling of Defects in Solids* at the Society of Engineering Science Annual Meeting of 2008.

Ph.D. Thesis Committee Member for David Schmidt (2009), Saurabh Puri (2009), Amit Das (2011) in Civil and Environmental Engineering, Carnegie Mellon University; Siddharth Hazra (2010) in Mechanical Engineering, Carnegie Mellon University; Eugene Trofimov (2010) in Mathematics, University of Pittsburgh

Grants

CAREER: A Multiscale Strategy for Nano- and Bio- Structures: Deformation, Defects, and Electromechanics, National Science Foundation, \$400,000 (2012 – 2017)

Young Investigator: A Multiscale Approach for Complex Functional Materials and Nanostructures, Air Force Office of Scientific Research, \$360,000 (2011 – 2014)

Dynamics of Structural Phase Transformations using Molecular Dynamics, Army Research Office, \$351,444 (2010 – 2013)

Temporal Coarse-graining of Molecular Dynamics by Efficient Data Warehousing of the Parametrized Locally Invariant Manifolds Method, National Science Foundation, \$418,709 (2009 – 2012)

PI: Kaushik Dayal; Co-PIs: Amit Acharya, Lucio Soibelman

————— Expired —————

Multiscale Methods for the Systematic Analysis and Design of Nanostructures and Nanostructured Materials, Air Force Office of Scientific Research, \$207,196 (2008 – 2011)

Symposium on Using Mechanics to Discover New Materials, Air Force Office of Scientific Research, \$5,000 (2008)

Teaching

Advanced Continuum and Multiscale Modeling of Engineering Materials

New advanced graduate course, jointly offered with Mechanical Engineering

Spring 2011 Feedback: 4.0/5.0 (Instructor), 3.8/5.0 (Course)

Fall 2011 Feedback: 4.8/5.0 (Instructor), 4.5/5.0 (Course)

Spring 2012

Continuum Mechanics of Materials

New core graduate course, jointly offered with Mechanical Engineering

Fall 2008 Feedback: 4.7/5.0 (Instructor), 4.2/5.0 (Course)

Fall 2009 Feedback: 4.7/5.0 (Instructor), 4.7/5.0 (Course)

Fall 2010 Feedback: 4.0/5.0 (Instructor), 4.2/5.0 (Course)

Solid Mechanics

Core undergraduate course

Spring 2009 Feedback: 3.3/5.0 (Instructor), 3.4/5.0 (Course)

Spring 2010 Feedback: 3.2/5.0 (Instructor), 3.4/5.0 (Course)

Spring 2011 Feedback: 3.8/5.0 (Instructor), 3.7/5.0 (Course)

Spring 2012

Graduate Seminars on Mechanics, Materials and Computing

Fall 2008 Feedback: 4.2/5.0 (Instructor), 3.9/5.0 (Course)

Fall 2010 Feedback: 4.2/5.0 (Instructor), 4.1/5.0 (Course)

CV UPDATED ON JANUARY 30, 2012.