# Ken Kamrin

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## Vital Statistics

Full name: Kenneth Norman Kamrin
Date of Birth: April 18, 1980
Place of Birth: Walnut Creek, California, United States of America
Citizenship: USA

## Education

*2003-2008* *Massachusetts Institute of Technology* *Ph.D. Applied Mathematics*

Doctorate in mathematics awarded Spring 2008 under the supervision of Prof. Martin Z. Bazant. Research focused on deriving and simulating new models for granular materials with an emphasis on flows, stresses, and their interdependence. Different microscopic flow mechanisms, both stochastic and continuous, have been employed in constructing multiple models each with versatility of use.
Cumulative GPA (converted to 4 point scaling): 4.000

*1998-2003* *University of California, Berkeley* *B.S. Engineering Physics, Mathematics minor*

Graduated with Highest Honors in the interdisciplinary Engineering Physics program which combines the physics curriculum with a broad range of upper level engineering and physical mathematics courses. Mathematics minor supplemented the major and provided transition to the graduate program.
Cumulative GPA: 4.000

## Employment

*2008-present* *Harvard University* *Applied Mathematics Lecturer and Postdoctoral Research Associate*

Conduct research and teaching in physical applied mathematics in the Harvard School of Engineering and Applied Sciences. Partial research sponsorship under Prof. John W. Hutchinson to study the dynamics of sand blasts with applications to the design of landmine-safe armoring for military vehicles. Starting 9/2009, funded half-time as National Science Foundation Postdoctoral Research Fellow (sponsor: Prof. L. Mahadevan).

## Fellowships

Winner of seven fellowships from various agencies and benefactors:

| *Fellowship* | *Date Awarded* |
|---|---|
| National Science Foundation Postdoctoral Research Fellowship | Spring 2009 |
| Aneesur Rahman Postdoctoral Fellowship | Fall 2007 |
| National Defense Science and Engineering Graduate Fellowship | Spring 2005 |
| National Science Foundation Graduate Research Fellowship | Spring 2005 |
| Hertz Fellowship (joint with Princeton) | Spring 2003 |
| MIT Applied Mathematics Fellowship | Spring 2003 |
| Akamai Presidential Fellowship | Spring 2003 |

## Honors

Harvard University Certificate of Distinction in Teaching, (2009)

UC Berkeley Certificate of Distinction (2003)
Awarded to the top four seniors in the university-wide graduating class

UC Berkeley Engineering Science Departmental Citation (2003)
Awarded to the top student in Engineering Science

Phi Beta Kappa Honor Society (2002)

Golden Key International Honor Society (2002)

UC Berkeley Student Learning Center, Highest Rated Group Instructor (2000)

Robert C. Byrd Scholarship (1998)

Bank of America Scholarship (1998)
First runner-up in the Fine Arts category

California Mathematics Council Recognition (1998)

## Teaching

Applied Mathematics Lecturer at Harvard University. Headed classes of ∼20-40 students in a faculty role.

| *Class* | *Description* | *Date* |
|---|---|---|
| Applied Mathematics 105A | Complex and Fourier Analysis | Fall 2009 |
| Applied Mathematics 147 | Nonlinear Dynamical Systems | Spring 2009 |
| Applied Mathematics 105A | Complex and Fourier Analysis | Fall 2008 |

Teaching Assistant in the MIT mathematics department. Taught bi-weekly recitations, graded homework and exams, and assigned final course grades for ∼20 students.

| *Class* | *Description* | *Date* |
|---|---|---|
| 18.03 | Differential Equations | Spring 2005 |
| 18.02A | Calculus 2 & start of Multivariable Calculus | Fall 2004 |

Taught undergraduate mathematics under two official titles at the UC Berkeley Student Learning Center: Group Instructor (GI) and Adjunct Course Instructor (ACI). As GI, led a bi-weekly review discussion for ∼20 students. As ACI, instructed a supplemental course for credit including exams. Two lectures per week, ∼25 students.

| *Class* | *Description* | *Date* | *Position* |
|---|---|---|---|
| Math 1B | Calculus 2 | Spring 2003 | GI |
| Math 54 | Linear Algebra & Differential Equations | Fall 2002 | GI |
| Math 53 | Multivariable Calculus | Spring 2002 | GI |
| Math 53 | Multivariable Calculus | Fall 2001 | GI |
| Math 1B | Calculus 2 | Spring 2001 | ACI |
| Math 55 | Discrete Math | Fall 2000 | GI |
| Math 55 | Discrete Math | Spring 2000 | GI |

## Professional Activities

Ad Hoc Reviewer, Proceedings of the Royal Society (2009)

Ad Hoc Reviewer, Physical Review (2006-current)

Member, American Mathematical Society (Fall 2003-current)

Member, American Physical Society (Fall 2003-current)

Member, Society for Industrial and Applied Mathematics (Fall 2003-current)

Organizer, Simple Person's Applied Math Seminar (Fall 2006 - Spring 2007)

Member, Committee on Special Scholarships, UC Berkeley Academic Senate (Fall 2002 - Spring 2003)

Member, Committee on Teaching, UC Berkeley Academic Senate (Fall 2001- Spring 2002)

## Publications

Ken Kamrin and Martin Z. Bazant, *Stochastic Flow Rule for Granular Materials*, Phys. Rev. E **75**, 041301 (2007).

Ken Kamrin, Chris H. Rycroft, and Martin Z. Bazant, *The Stochastic Flow Rule: A Multi-Scale Model for Granular Plasticity*, Modelling Simul. Mater. Sci. Eng. **15**, S449-S464 (2007).

Chris H. Rycroft, Ken Kamrin, and Martin Z. Bazant, *Assessing Continuum Postulates in Simulations of Granular Flow*, J. Mech. Phys. Solids **57**:5 828-839 (2009).

Ken Kamrin, *Nonlinear Elasto-Plastic Model for Dense Granular Flow* (In Press: Int. J. Plasticity).

Ken Kamrin and Jean-Christophe Nave, *An Eulerian Approach to the Simulation of Deformable Solids: Application to Finite-Strain Elasticity*, (Submitted. See arXiv:0901.3799)

Ken Kamrin, Howard A. Stone, and Martin Z. Bazant, *Effective Slip Boundary Conditions for Arbitrary Periodic Surfaces: The Surface Mobility Tensor*, (Submitted. See arXiv:0911.1328).

Ken Kamrin, Georg Koval, and Francois Chevoir, *Flow Relations in Quasi-Static and Inertial Granular Flow*, (In preparation).

Ken Kamrin, Yang Zhang, and Jean-Christophe Nave, *Fully Eulerian Method for Fluid/Solid Interaction*, (In preparation).

Chris H. Rycroft, Gary S. Grest, and Ken Kamrin, *Analysis of Granular Flow in a Cone*, (In preparation)

Ken Kamrin, Howard A. Stone, and Martin Z. Bazant, *Laminar Flows in Textured Pipes and Couette Cells*, (In preparation).

## Conference Presentations

*Invited*

*The Stochastic Flow Rule: A Multi-scale Model for Granular Plasticity*, 7th World Congress of Computational Mechanics, Los Angeles, July 2006.

*Other*

*General Continuum Law for Dense Granular Flow*, 7th Northeastern Granular Materials Workshop, Yale University, June 2009.

*Nonlinear Elasto-plasticity for Dense Granular Flow*, Greater Boston Area Statistical Mechanics Meeting, Brandeis University, October 2008.

*A Nonlinear Elasto-plastic Model for Dense Granular Flow*, 30th New England Complex Fluids Workshop, Harvard University, December 2007.

*The Stochastic Flow Rule and Rate Sensitivity in Dense Granular Flows*, APS March Meeting, Denver, March 2007.

*Testing the Stochastic Flow Rule*, 29th New England Complex Fluids Workshop, Harvard University, December 2006.

*A Stochastic Flow Rule for Dense Granular Plasticity*, 4th Northeastern Granular Materials Workshop, City College of New York, June 2006.

*A Theory of Stochastic Plasticity for Dense Granular Flow*, APS March Meeting, Baltimore, March 2006.

*Evaluation and Comparison of Continuum Models for Dense Granular Flow*, 3rd Northeastern Granular Materials Workshop, Wesleyan University, June 2005.

*Evaluation and Comparison of Continuum Models for Dense Granular Flow*, APS March Meeting, Los Angeles, March 2005.

## Departmental Presentations

*Invited*

*General Continuum Law for Dense Granular Flow*, Sandia National Laboratory, July 2009.

*General Continuum Law for Dense Granular Flow*, Brandeis University Department of Physics, June 2009.

*A Continuum Model for the Deformation of Granular Materials*, Clark University, Physics Colloquium, February 2009.

*A New Continuum Model for Dense Granular Deformations*, Univeristy of California, Santa Barbara, Kavli Institute for Theoretical Physics, March 2008.

*A New Continuum Model for Dense Granular Deformations*, Solid Earth Physics Seminar, Harvard School of Engineering and Applied Sciences, February 2008.

*An Elasto-Plastic Model for Dense Granular Flow*, Brown University Department of Mechanical Engineering, February 2008.

*An Elasto-Plastic Model for Dense Granular Flow*, Yale University Departments of Physics and Mechanical Engineering (joint seminar), February 2008.

*An Elasto-Plastic Model for Dense Granular Flow*, Institut Universitaire des Systèmes Thermiques Industriels, Polytech Marseille, January 2008.

*An Elasto-Plastic Model for Dense Granular Flow*, Institut Navier, École Nationale des Ponts et Chaussées, January 2008.

*An Elasto-Plastic Model for Dense Granular Flow*, Theoretical Chemical-Physics, École Supérieure de Physique et de Chimie Industrielles, January 2008.

*An Elasto-Plastic Model for Dense Granular Flow*, Physics and Mechanics of Heterogeneous Media, École Supérieure de Physique et de Chimie Industrielles, January 2008.

*Detailed Story of the Stochastic Flow Rule*, Clark University Department of Physics, October 2006.

*Flow Rules in Granular Plasticity*, Brown Bag Seminar Series, MIT Applied Mathematics, March 2005.

*Student-level*

*Mathematics in Music: How the modern day music scales were constructed*, Simple Person's Applied Math Seminar, MIT Applied Mathematics, October 2007.

*What's the Deal with Entropy and Temperature?* Simple Person's Applied Math Seminar, MIT Applied Mathematics, April 2007.

*Take the (1/2)th Derivative of This! An introduction to fractional calculus and its applications*, Simple Person's Applied Math Seminar, MIT Applied Mathematics, October 2006.

*Gambling Tactics: Cashing in on applied math*, Simple Person's Applied Math Seminar, MIT Applied Mathematics, May 2006.

*Fibonacci Numbers and the Golden Ratio: Natural beauty through optimization*, Simple Person's Applied Math Seminar, MIT Applied Mathematics, December 2005.
*Fun with Variational Calculus*, Simple Person's Applied Math Seminar, MIT Applied Mathematics, April 2005.

*Informal* *Stochastic and Deterministic Models for Granular Flow*, Research group of Dr. Igor Aronson, Argonne National Laboratory, Materials Science Division, August 2007.

*Solid Mechanics and its Application to Granular Flow* (series of 10 lectures), Dry Fluids Group, MIT Applied Mathematics, July 2004.

## Software Proficiency

Proficient in MATLAB and Mathematica and experienced in Fortran 90 and C. Knowledge of the finite element method software package ABAQUS and the encoding of explicit user-material subroutines (VUMAT). Experienced with html.

## References

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|---|---|---|
| Prof. Martin Z. Bazant | MIT Applied Mathematics | bazant@math.mit.edu |
| Prof. Ruben Rosales | MIT Applied Mathematics | rrr@math.mit.edu |
| Prof. Lallit Anand | MIT Mechanical Engineering | anand@mit.edu |
| Dr. Igor Aronson | Argonne National Laboratory | aronson@anl.gov |
| Prof. L. Craig Evans | UC Berkeley Mathematics | evans@math.berkeley.edu |
| Prof. John W. Hutchinson | Harvard SEAS | jhutchin@fas.harvard.edu |
| Prof. L. Mahadevan | Harvard SEAS | lm@seas.harvard.edu |
| Prof. James S. Langer | UC Santa Barbara Physics | langer@physics.ucsb.edu |