

Prashant K. Purohit

(<http://www.seas.upenn.edu/~purohit>)

Education

Indian Institute of Technology, Delhi, B.Tech., Mechanical Engineering, 1993-1997.
California Institute of Technology, Pasadena, M. S., Applied Mechanics, 1997-1998.
California Institute of Technology, Pasadena, Ph.D., Applied Mechanics, 1998-2001.
Ph.D. Thesis: *Dynamics of phase boundaries in strings, beams and atomic chains*.

Positions held

01/06-present Assistant Professor, Mechanical Engineering and Applied Mechanics, University of Pennsylvania.
09/04-12/05 Postdoctoral scholar, Physics and Astronomy, University of Pennsylvania.
12/01-08/04 Postdoctoral scholar, Mechanical Engineering, California Institute of Technology.
09/97-11/01 Research assistant, Mechanical Engineering and Applied Mechanics, California Institute of Technology.

Honors/Awards

1. *Charles Lee Powell Graduate Fellowship*, California Institute of Technology, Pasadena, 1997.
2. *Silver medal* for graduating with the highest GPA in the mechanical engineering class, Indian Institute of Technology, Delhi, 1997.
3. NSF CAREER Award 2010, "Entropic elasticity of fluctuating filaments and networks".
4. Ferdinand P. Beer and E. Russell Johnston, Jr., Outstanding New Mechanics Educator Award, 2010, from the American Society for Engineering Education.

Research interests

Statistical mechanics of DNA and filamentous bio-molecules, bio-polymer networks and bio-membranes, martensitic phase transitions in solids, micro-scale propulsion.

Editorial boards

1. Member of the Editorial Board of the journal 'Molecular and Cellular Biomechanics'.

Professional Societies

1. Member of the Society of Engineering Science,
2. Member of the Society of Industrial and Applied Mathematics.

Professional Service

1. Served on review panels for NSF, CMMI, 2009, 2010, 2011.
2. Co-organizer of the mini-symposium on 'Entropic Solid Mechanics' in the SIAM conference on the Mathematical Aspects of Materials Science, May 2010.
3. Co-organizer of the mini-symposium on 'Coarse-grained and multi-scale modeling in molecular and cellular biomechanics' at the US National Congress on Computational Mechanics-10, 2009.

4. Co-organizer of the mini-symposium on 'Biophysics problems in the mechanics of rods, surfaces and particles and their interactions with viscous fluids', SIAM conference on the mathematical aspects of materials science, 2008.
5. Co-chair of session on 'Bio-Inspired problems in Elasticity', ASME Mechanics of Materials Conference, 2007.
6. Co-chair of session at the World Conference on Computational Mechanics, Los Angeles, California, 2006.

University service

1. MEAM seminar chair, Fall 2007-present.
2. Organized a 'Panel discussion on research careers in industry' and 'Graduate research poster exchange' for the Nano/Bio Interface Center at Penn, 2008, 2009, 2010.
3. Member of MEAM faculty search committee for the micro/nano search, 2006, 2008.
4. Member of MEAM graduate admissions committee, 2006 – present.
5. Member of MEAM undergraduate curriculum review committee, 2006.
6. Member of Academic Performance Committee, 2006 – present.

Invited seminars and conferences

1. Department of Mechanical Engineering, Stanford University, February, 2011. (*Mechanics and computation seminar*).
2. NSF-CMMI conference, Atlanta, January, 2011.
3. Department of Mechanical and Aerospace Engineering, University of California, Los Angeles, December, 2010. (*Structural and solid mechanics seminar*).
4. ASME International Mechanical Engineering Congress and Exposition, Vancouver, Canada, November, 2010.
5. Workshop on Mathematical Foundations of Mechanical Biology, Banff, Canada, September, 2010.
6. National Center for the Biological Sciences, TIFR, Bangalore, India, August 2010. (*Departmental seminar*).
7. Department of Mechanical Engineering, Indian Institute of Science, Bangalore, India, August 2010. (*Departmental seminar*).
8. 4th Shanghai International Conference on Biophysics and Molecular Biology, Shanghai-Jiashan, August 2010.
9. 16th US National Congress on Theoretical and Applied Mechanics, College Station, Pennsylvania, July 2010.
10. European Conference on Computational Mechanics, Paris, May 2010. (*Keynote talk.*)
11. SIAM conference on Mathematical Aspects of Materials Science, Philadelphia, May 2010.
12. Materials Research Society Conference, San Francisco, April 2010.
13. JSME Young Researchers Symposium, California Institute of Technology, Pasadena, March, 2010.
14. Nano Engineering in Medicine and Biology Conference, Houston, February 2010.
15. Department of Mechanical Engineering, Johns Hopkins University, Baltimore, Maryland, February, 2010. (*Departmental seminar*).
16. Department of Physics, Vrije University, Amsterdam, September 2009. (*Seminar*).
17. European Solid Mechanics Conference, Lisbon, Portugal, September 2009.
18. ASME-IDETC conference, San Diego, August 2009.

19. Summer school on New Trends in the Physics and Mechanics of Biological Systems, Les Houches, France, July 2009.
20. Department of Chemical and Biomolecular Engineering, University of Pennsylvania, Philadelphia, February 2009. (*Departmental seminar*).
21. Single molecule biophysics world networking workshop, Drexel University, February 2009.
22. Society of Engineering Science, University of Illinois, Urbana-Champaign, October 2008.
23. ICTAM, Adelaide, Australia, August 2008.
24. IUTAM symposium on cellular, molecular and tissue mechanics, Woodshole, June, 2008.
25. SIAM conference on the Mathematical Aspects of Materials Science, Philadelphia, May, 2008.
26. Department of Theoretical and Applied Mechanics, Cornell University, Ithaca, April 2008. (*Departmental seminar*).
27. Department of Applied Mechanics, Indian Institute of Technology, Madras, Chennai, India, January 2008. (*Departmental seminar*).
28. US-India Nano Science and Engineering Institute, Chennai, India, January 2008.
29. Solid Mechanics, Brown University, Providence, October 2007. (*Departmental seminar*).
30. Society of Engineering Science, Texas A&M University, October, 2007.
31. ASME Mechanics of Materials Conference, University of Texas, Austin, June 2007.
32. Centennial celebrations of Mechanical Engineering at California Institute of Technology, Pasadena, March 2007.
33. Workshop in Nanomechanics of Biomolecules, Ascona, Switzerland, August 2006.
34. World Conference on Computational Mechanics, Los Angeles, California, July 2006.
35. Gordon Research Conference on Single Molecule Approaches to Biology, New London, New Hampshire, June 2006.
36. Materials Research Society Meeting, San Francisco, California, March 2005.
37. Biophysical Society Meeting, Long Beach, California, February 2005.
38. Single Molecule Biophysics Workshop, Aspen, Colorado, January 2005.
39. SIAM Conference on Mathematical Aspects of Materials Science, Los Angeles, California, May 2004.
40. NATO Summer School on Soft Condensed Matter Physics in Molecular and Cell Biology, University of Edinburgh, Scotland, April 2004.
41. Department of Inorganic and Physical Chemistry, Indian Institute of Science, Bangalore, India, December 2003. (*Departmental seminar*).
42. Workshop on Discrete models for Materials, University of Warwick, England, June 2003.
43. US National Congress on Theoretical and Applied Mechanics, Blacksburg, Virginia, July 2002.
44. Workshop on Atomistic and Continuum Models for Long Molecules and Thin Films, Ascona, Switzerland, July 2001.
45. ASME International Mechanical Engineering Congress and Exposition, Orlando, Florida, November, 2000.
46. 20th International Congress of Theoretical and Applied Mechanics, Chicago, Illinois, August, 2000.

Current and pending grants

1. "Tuning the mechanical properties of fibrin gels by altering the nanoscale structure of fibrin", Prashant K. Purohit and John W. Weisel, Amount - \$50,000, Sept 2010-Jun 2011.

2. "CAREER: Entropic elasticity of fluctuating filaments and networks", Prashant K. Purohit, Amount - \$400,000, July 2010-Jun 2015.
3. "Analysis of moving unfolding fronts in long protein molecules", Prashant K. Purohit. (pending with CMMI, NSF), Amount - \$297,000.
4. "Buckled piezoelectric ribbons and films: Morphology, mechanics and enhanced performance", Michael C. McAlpine and Prashant K. Purohit. Amount - \$450,000. (pending with CMMI, NSF).

Graduate students (and postdocs) supervised

1. David Argudo, MEAM Ph.D. student.
2. Ritwik Raj, MEAM Ph.D. student.
3. Tianxiang Su, MEAM Ph.D. student.
4. Neeraj Agrawal, CBE Ph.D. (graduated 2009, advisor – Ravi Radhakrishnan).
5. Mark Arsenault, MEAM Ph.D. (graduated 2009, advisor – Haim Bau).
6. Josue Sznitman, MEAM post-doc (advisor – Paulo Arratia).
7. Andre E. X. Brown, Physics Ph.D. (graduated 2009, advisor – Dennis Discher).

Courses taught

1. MEAM 354 Mechanics of Solids, Fall 2006, Spring 2008, Spring 2009, Spring 2010, Spring 2011.
2. MEAM 663 Entropic Forces in Biomechanics, Spring 2007, Fall 2008, Fall 2010.
3. MEAM 519 Elasticity, Fall 2007, Fall 2009.

Collaborative efforts (ongoing)

1. "Multiscale mechanics of fibrin networks", with John W. Weisel, Department of Cell and Developmental Biology and Dennis E. Discher, Department of Bioengineering, University of Pennsylvania.
2. "Swimming of *C. elegans*" with Paulo Arratia, Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania.
3. "Buckled PZT nanoribbons for nanoscale energy generation", with Michael C. McAlpine, Department of Mechanical and Aerospace Engineering, Princeton University.
4. "Fluctuations of DNA in nanochannels", with BioNanomatrix, 3701 Market Street, Philadelphia. (BioNanomatrix is a start-up company developing nanoscale imaging and analytic platforms for analyzing genomes).

Book chapters

1. "Mechanics of biological nanotechnology", Rob Phillips, Prashant K. Purohit and Jane' Kondev, chapter in *Springer handbook of nanotechnology*, Springer-Verlag, 693-727, (2003).

Refereed journal publications

1. "Fluctuating elastic filaments under distributed loads", Tianxiang Su and Prashant K. Purohit, To appear in *Molecular and Cellular Biomechanics*, (2011).
2. Entropically driven diffusion – Application to motion of polymers in non-uniform nanochannels", Tianxiang Su and Prashant K. Purohit, To appear in *Phys. Rev. E*, (2011).
3. "Phase boundaries as agents of structural change in macromolecules", Ritwik Raj and Prashant K. Purohit, (submitted to *JMPS*).

4. "A variational approach to the mechanical response of plectonemic DNA", David Argudo and Prashant K. Purohit, (submitted to *JMPS*).
5. "Enhanced piezoelectricity and stretchability in energy harvesting devices fabricated from buckled PZT ribbons", Yi Qi, Thanh D. Nguyen, Bozhena Lisko, Prashant K. Purohit, and Michael C. McAlpine, *Nano Letters*, (2011).
6. "Protein unfolding accounts for the unusual mechanical behavior of fibrin networks", Prashant K. Purohit, Rustem I. Litvinov, Andre E. X. Brown, Dennis E. Discher, and John W. Weisel, *Acta Biomaterialia* **7**, 2374-2382, (2011).
7. "Transition between two regimes describing internal fluctuation of DNA in a nanochannel", Tianxiang Su, Somes K. Das, Ming Xiao and Prashant K. Purohit, *PLoS One* **6**, e16890, (2011).
8. "Comparison of Brownian-dynamics-based estimates of polymer tension with direct force measurements", Mark E. Arsenault, Prashant K. Purohit, Yale E. Goldman, Henry Shuman, and Haim H. Bau, *Phys. Rev. E*, **82**, 051923, (2010).
9. "Moving interfaces in rod-like macromolecules", Ritwik Raj and Prashant K. Purohit, *Europhys. Lett.* **91**, 28003, (2010).
10. "The effects of fluid viscosity on the kinematics and material properties of *C. elegans* swimming at low Reynolds number", Josue Sznitman, Xiaoning Shen, Prashant K. Purohit, Paulo E. Arratia, To appear in *Journal of Experimental Mechanics*, (2010).
11. "Thermomechanics of heterogeneous fluctuating chains", Tianxiang Su and Prashant K. Purohit, *J. Mech. Phys. Solids*, **58**, 164-186, (2010).
12. "The material properties of swimming nematodes reveal novel muscle phenotypes", Josue Sznitman, Prashant K. Purohit, Predrag Krajacic, Todd Lamitina and Paulo E. Arratia, *Biophys. J.*, **98**, 617-626, (2010).
13. "Multiscale mechanics of fibrin polymer", Andre E. X. Brown, Rustem I, Litvinov, Dennis E. Discher, Prashant K. Purohit, John W. Weisel, *Science*, **325**, 741-744, (2009).
14. "Mechanics of forced unfolding of proteins", Tianxiang Su and Prashant K. Purohit, *Acta Biomaterialia*, **5**, 1855-1863, (2009).
15. "Analytical and numerical solutions for shapes of quiescent 2D vesicles", Shravan Veerapaneni, Ritwik Raj, George Biros and Prashant K. Purohit, *Intl. J. Nonlin. Mech.*, **44**, 257-262, (2009).
16. "Plectoneme formation in twisted fluctuating rods", Prashant K. Purohit, *J. Mech. Phys. Solids*, **56**, 1715-1729, (2008).
17. "Geometry of mediating protein affects the probability of loop formation in DNA", Neeraj Agrawal, Ravi Radhakrishnan and Prashant K. Purohit, *Biophys. J.*, **94**(8), 3150-3158, (2008).
18. "The mechanics of short rod-like molecules in tension", Prashant K. Purohit, Mark E. Arsenault, Yale E. Goldman and Haim H. Bau, *Intl. J. Nonlin. Mech.*, **43**, 1056-1063, (2008).
19. "Confinement and manipulation of actin filaments by electric fields", Mark Arsenault, Hui Zhao, Prashant K. Purohit, Yale E. Goldman and Haim H. Bau, *Biophys. J.*, **93**(8), L42-L44, (2007).
20. "Effect of supercoiling on formation of protein mediated DNA loops", Prashant K. Purohit and Philip C. Nelson, *Phys. Rev. E*, **74**, pp061907 (1-14), (2006).
21. "The effect of genome length on ejection forces in bacteriophage lambda", Paul Grayson, Alex Evilevitch, Mandar Inamdar, Prashant K. Purohit, William Gelbart, Charles Knobler and Rob Phillips, *Virology*, **348**, 430-436, (2006).

22. "Forces during viral DNA packaging and ejection", Prashant K. Purohit, Mandar Inamdar, Paul Grayson, Todd Squires, Jane Kondev and Rob Phillips, *Biophys. J.*, **88**, 851-866, (2005).
23. "Mechanics of DNA packaging in viruses", Prashant K. Purohit, Jane Kondev and Rob Phillips, *Proc. Natl. Acad. Sci.*, **100**(6), 3173-3178, (2003).
24. "Force steps during viral DNA packaging". Prashant K. Purohit, Jane Kondev and Rob Phillips, *J. Mech. Phys. Solids*, **51**, 2239-2257, (2003).
25. "Dynamics of strings made of phase transforming materials", Prashant K. Purohit and Kaushik Bhattacharya, *J. Mech. Phys. Solids*, **51**, 393-424, (2003).
26. "Mobility of twin and phase boundaries", K. Bhattacharya, P. Purohit and B. Craciun, *J. de Physique IV*, **112**, 163-166, (2003).
27. "On beams made of phase transforming materials", Prashant K. Purohit and Kaushik Bhattacharya, *Intl. J. of Solids Structures*, **39**, 3907-3929, (2002).

Refereed conference publications

1. "Mechanics of heterogeneous fluctuating elastic rods", Tianxiang Su and Prashant K. Purohit, (8 pages, *Proceedings of the ASME-IDEFC 2009 conference, San Diego*).
2. "Shape and energetics of DNA plectonemes", Prashant K. Purohit, Chapter in IUTAM book series, "*IUTAM symposium in Cell, Molecular and Tissue Mechanics*", Springer, ISBN 978-90-481-3347-5, (Editors: K. Garikipati and E.M. Arruda), (2010).
3. "Dynamics of strings made of phase transforming materials", *Proceedings of the 20th International Congress on Theoretical and Applied Mechanics*, (2001).