

# Nikhil Chandra Admal

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## Employment

University of California, Los Angeles, California

- Sep 2014–Present      **Postdoctoral Research Scholar**, Materials Science and Engineering  
*Advisor:* Jaime Marian
- ▶ Continuum modeling of recrystallization in refractory materials - Tungsten
  - ▶ Derivation of atomistic representations of strain gradient elasticity tensors.
- Sep 2013–Dec 2013      **Visiting Research Scholar**, Institute for Pure and Applied Mathematics

## Education

The University of Minnesota, Minneapolis, MN, 2007–2014

- Sep 2014                      **Ph.D. Aerospace Engineering and Mechanics**, GPA: 3.917  
*Dissertation:* Results on the interaction between atomistic and continuum models  
*Advisor:*      Ellad B. Tadmor
- Dec 2011                      **M.S. Mathematics**  
Concentration in Real and Functional analysis
- Aug 2010                      **M.S. Aerospace Engineering and Mechanics**  
*Dissertation:* A unified interpretation of stress in molecular systems  
*Advisor:*      Ellad B. Tadmor
- Indian Institute of Technology (IIT) Madras, Chennai, TN, India, 2001–2006
- Aug 2006                      **B.Tech., M.Tech. Dual Degree in Mechanical Engineering**  
*Minor:*      Vibrations Concepts and Applications  
*Thesis:*      Conjugate heat transfer through conical pipes and Optimization of functionally graded materials in circular pipe  
*Advisor:*      N. Ganesan

## Research and Teaching Interests

*Research:*                      Microscopic foundations of continuum mechanics, Multiscale modeling and simulation of materials, Numerical analysis of multiscale modeling

*Teaching:*                      Statics and particle dynamics, Mechanics of solids, Continuum mechanics, Linear elasticity, Nonlinear elasticity, Multiscale modeling of materials

## Teaching Experience

University of California Los Angeles,

- May 2015                      **Taught 2 two-hour sessions**, Materials Science and Engineering  
MSE298      Numerical Methods to Study Materials Behavior across Multiple Length and Time Scales

## Previous Employment

The University of Minnesota, Minneapolis, MN

Sep 2007–Sep 2012     **Graduate Student Research Assistant**

- ▶ Investigated the microscopic foundations of continuum mechanics which play a central role in multiscale methods involving the interaction of atomistic and continuum models. In particular, the definition of stress in an atomistic system, has been extensively studied.
- ▶ A unified interpretation of stress tensor in molecular systems is given which unifies all the existing definitions, and identifies various sources of non-uniqueness in the stress tensor.
- ▶ New definitions for the heat flux vector and the energy density are derived. These definitions avoid the ambiguous decomposition of energy among the particles of an atomistic system.
- ▶ Studied the non-uniqueness of the atomistic stress tensor arising from the non-uniqueness of the force decomposition. A geometric interpretation of force decomposition was given using rigidity theory and its non-uniqueness is characterized. This analysis resulted in a decomposition of the atomistic stress into an irrotational part and a solenoidal part. A similar decomposition is constructed for the continuum Cauchy stress tensor using the generalized Beltrami representation, which is a version of Helmholtz decomposition for symmetric tensor fields.
- ▶ Proposed definitions for material descriptions of atomistic fields.

Jan 2007–May 2007     **Graduate Student Teaching Assistant**

- ▶ Delivered recitations for 2 classes of 30 students each.
- ▶ Prepared and graded examinations and homework assignments for the courses Deformable Body Mechanics and Aerospace Structures.

Indian Institute of Technology (IIT) Madras, Chennai, TN, India

Aug 2005–Apr 2006     **Graduate Research Assistant**

- ▶ Study of conjugate heat transfer in conical pipes and the design of functionally graded materials to minimize thermal stresses.

Micro and Nano Structure Technology Lab, GE: John F. Welch Technology Center, Bangalore, Karnataka, India

Apr 2005–Jul 2005     **Intern**

- ▶ Designed a differential pressure-based MEMS flow sensor for anaesthesia delivery systems by modeling the fluid structure interaction in this device using ANSYS and COVENTOR.
- ▶ Developed a Surface Plasmon Resonance (SPR) sensor for sensing analytes like phosphates in water, and elemental mercury in power plants.

## Honors and Awards

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| 2016      | <i>Institute for Digital Research and Education (IDRE) Postdoctoral Fellowship-\$9000</i> , University of California Los Angeles, CA |
| 2012–2013 | <i>Doctoral Dissertation Fellowship</i> , University of Minnesota, Minneapolis, MN   |
| 2007      | <i>Summer Fellowship</i> , Aerospace Engineering and Mechanics, Minneapolis, MN  |

- 2005 *Inventor Bonus Award*, GE: John F. Welch Technology Center, Bangalore, India
- 2005 *Best Outgoing Intern*, awarded by GIPLo Lab, GE: John F. Welch Technology Center, Bangalore, India
- 2004 *Percentile of 98.19 in Graduate Aptitude Test in Engineering (GATE) 2004*, India
- 2001–2005 *Pratibha scholarship*, State government of Andhra Pradesh, India
- 2001 *Ranked 1081 in IIT Joint Entrance Examination among over 200,000 aspirants*

### Travel Grants

- MMM 2016 *From the organizers of the 8th International Conference on Multiscale Materials Modeling, Dijon, France*

### Journal Articles

- 1 N. C. Admal, E. B. Tadmor. “A unified interpretation of stress in molecular systems.” *Journal of Elasticity*, 100:63–143, 2010
- 2 N. C. Admal, E. B. Tadmor. “Stress and heat flux for arbitrary multibody potentials: A unified framework.” *The Journal of Chemical Physics*, 134:184,106, 2011
- 3 Nikhil Chandra Admal, E.B. Tadmor. “The non-uniqueness of the atomistic stress tensor and its relationship to the generalized beltrami representation.” *Journal of the Mechanics and Physics of Solids*, 93:72 – 92, 2016. Special Issue in honor of Michael Ortiz
- 4 Nikhil Chandra Admal, Ellad B Tadmor. “Material fields in atomistics as pull-backs of spatial distributions.” *Journal of the Mechanics and Physics of Solids*, 89:59–76, 2016
- 5 N. C. Admal, J. Marian, Giacomo Po. “The atomistic representation of first strain-gradient elastic tensors.” *Journal of the Mechanics and Physics of Solids*, 2016. URL <https://arxiv.org/pdf/1608.00637>
- 6 N. C. Admal, J. Marian. “Polycrystalline crystal plasticity with grain boundary evolution.” *Journal of the Mechanics and Physics of Solids*, 2016. In prepration
- 7 N. C. Admal, J. Marian. “Polycrystalline crystal plasticity.” *Modeling and Simulation in Materials Science and Engineering*, 2016. In prepration
- 8 G. Po, M. Lazar, D. Seif, N. C. Admal, N. Ghoniem. “An anisotropic non-singular theory of dislocations with atomic resolution.” *Journal of Mechanics and Physics of Solids*, 2016. In preparation

### Technical Publications

- 1 Nikhil Chandra Admal. *A unified interpretation of stress in molecular systems*. Master’s thesis, University of Minnesota, Department of Aerospace Engineering and Mechanics, Minneapolis, MN 55455, 2010
- 2 Nikhil Chandra Admal. *Results on the interaction between atomistic and continuum models*. Ph.D. thesis, University of Minnesota, Department of Aerospace Engineering and Mechanics, Minneapolis, MN 55455, 2014

### Invited Talks

- 1 “The non-uniqueness of the atomistic stress tensor and its relationship to the generalized Beltrami representation.” Fifteenth Pan-American Congress of Applied Mechanics, Champaign, IL, May 2015
- 2 “The atomistic representations of strain gradient elasticity tensors.” 2nd Schöntal Symposium: Dislocation based Plasticity, Schöntal, Germany, February 2016

## Technical Presentations

- 1 “A unified interpretation of stress in molecular systems.” 16th U.S. National Congress of Theoretical and Applied Mechanics, University Park, PA, June 2010
- 2 “Interatomic potentials, forces and the stress tensor.” Future directions in mechanics research, NSF workshop and symposium in honor of Professor L. B. Freund, Providence, RI, June 2011
- 3 “Stress and heat flux for arbitrary multibody potentials.” 11th U.S. National Congress on Computational Mechanics, Minneapolis, MN, July 2011
- 4 “Interatomic potential energy representation and the atomistic stress tensor.” Society for Engineering and Science, Providence, RI, July 2013
- 5 “Interatomic potential energy representation and the atomistic stress tensor.” Graduate Aerospace Laboratories, Caltech, CA, August 2013
- 6 “Interpretation of stress in molecular systems.” Institute for Pure and Applied Mathematics, UCLA, CA, November 2013
- 7 “A decomposition of the atomistic stress into an elastic and a residual component.” Society for Natural Philosophy Meeting: Mathematics and Mechanics in the Physical Sciences, A Tribute to James Serrin, University of Minnesota, November 2013
- 8 “The elastic-plastic decomposition of the atomistic stress tensor.” The Minerals, Metals and Materials Society, San Diego, CA, February 2014
- 9 “Referential continuum fields in atomistics.” 13th US National Congress on Computational Mechanics, San Diego, CA, 2015
- 10<sup>†</sup> “A diffuse-interface elasto-plastic model to study grain boundary evolution.” 8th International Conference on Multiscale Materials Modeling, Dijon, France, October 2016

## Book Chapters

- 1 N. C. Admal, E. B. Tadmor. *Statistical mechanics, molecular modeling, and the notion of stress*, chapter A unified interpretation of stress in molecular systems. Springer, New York, 2010

## Patents

- 1 Nikhil C. Admal, Parag Thakre, Atanu Phukan, Sriharsha Aradhya. *MEMS flow sensor*. Number US 7337678 B2. Issued March 2008

## Professional Service Activities

Journal Referee

**International Journal of Plasticity** (×1)

**Nano Letters, ACS Publications** (×1)

**Journal of Statistical Physics** (×1)

**Mechanics of Materials** (×1)

**Acta Materialia** (×1)

**Journal of Chemical Theory and Computation** (×1)

**Archive for Rational Mechanics and Analysis** (×1)

**Journal of Elasticity** (×1)

**Modeling and Simulation in Materials Science and Engineering** (×2)

**Physical Review E** (×1)  
**Physical Letters A** (×1)  
**Nuclear Inst. and Methods in Physics Research, B** (×1)  
**International Journal of Solids and Structures** (×3)  
**Fusion Science and Technology** (×1)  
**Journal of Mechanics and Physics of Solids** (×1)

#### Technical Conference Activities

USNCCM 2015      **Symposium co-organizer, Atomistic computation of continuum quantities**

Knowledgebase of Interatomic Models (<http://openkim.org>)

2012–Present      **Contributor**

I am an active contributor to the KIM repository of interatomic potentials and tests.

#### Students Mentored

Undergraduate

Feng Cao      Materials Science and Engineering, Univeristy of California Los Angeles. Thesis title: *Calculation of grain boundary energies using atomistics*In preparation

#### Software

- 1 *MDStressLab version 1.0.0*, Released: September 2015. URL <http://mdstresslab.org>. N. C. Admal, E. B. Tadmor

#### Relevant Skills

*Software:*      Unix/Linux, Windows, Matlab, Mathematica, perl, Fortran, C, C++, L<sup>A</sup>T<sub>E</sub>X, B<sub>I</sub>B<sub>T</sub><sub>E</sub>X, Asymptote, GNUplot, ANSYS, AutoCad

#### References

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