

## Nikhil Chandra Admal

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University of Illinois at Urbana-Champaign  
Department of Mechanical Science and Engineering  
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### Employment

University of Illinois at Urbana-Champaign, Illinois

Jan 2019–Present      **Assistant Professor**, Mechanical Science and Engineering

University of California, Los Angeles, California

Sep 2014–Jan 2019      **Postdoctoral Research Scholar**, Materials Science and Engineering

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*

Dec 2011      **M.S.** *Mathematics*  
Concentration in Real and Functional analysis

Aug 2010      **M.S.** *Aerospace Engineering and Mechanics*

Indian Institute of Technology (IIT) Madras, Chennai, TN, India, 2001–2006

Aug 2006      **B.Tech., M.Tech.** *Dual Degree in Mechanical Engineering*

### Research Interests

*Research:*      Interfacial mechanics of grain/phase boundaries and 2D heterostructures; Defect mechanics and crystal plasticity; Severe plastic deformation - recovery, recrystallization, grain growth; Nanocrystalline alloys; Microscopic foundations of continuum mechanics and gradient elasticity; Multiscale modeling and simulation of materials; Numerical analysis of multiscale modeling

### Honors and Awards

- 2019 *Listed in "Teachers ranked as excellent" by the Center for Innovation in Teaching & Learning (CITL) for Spring 2019, University of Illinois at Urbana-Champaign, IL*
- 2016 *Institute for Digital Research and Education (IDRE) Postdoctoral Fellowship \$9000, University of California Los Angeles, CA*
- 2012–2013 *Doctoral Dissertation Fellowship, University of Minnesota, Minneapolis, MN*
- 2007 *Summer Fellowship, University of Minnesota, 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*
- USACM 2016 *USACM Workshop on Recent Advances in Computational Methods for Nanoscale Phenomena, Ann Arbor, MI*

### **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*, 99:93 – 115, 2017
- 6 Nikhil Chandra Admal, Giacomo Po, Jaime Marian. "Diffuse-interface polycrystal plasticity: Expressing grain boundaries as geometrically necessary dislocations." *Materials Theory*, 1(1):6, 2017

- 7 Giacomo Po, Markus Lazar, Nikhil Chandra Admal, Nasr Ghoniem. “A non-singular theory of dislocations in anisotropic crystals.” *International Journal of Plasticity*, 103:1–22, 2018
- 8 Nikhil Chandra Admal, Giacomo Po, Jaime Marian. “A unified framework for polycrystal plasticity with grain boundary evolution.” *International Journal of Plasticity*, 106:1–30, 2018
- 9 Giacomo Po, Nikhil Chandra Admal, Markus Lazar. “The green tensor of Mindlin’s anisotropic first strain gradient elasticity.” *Materials Theory*, 3(1):3, Mar 2019. ISSN 2509-8012
- 10 Nikhil Chandra Admal, Javier Segurado, Jaime Marian. “A three-dimensional misorientation axis- and inclination-dependent Kobayashi–Warren–Carter grain boundary model.” *Journal of the Mechanics and Physics of Solids*, 2019. ISSN 0022-5096
- 11 Giacomo Po, Nikhil Chandra Admal, Bob Svendsen. “Non-local thermoelasticity based on equilibrium statistical thermodynamics.” *Journal of Elasticity*, pp. 1–23, 2019
- 12 M Shi, NC Admal, EB Tadmor. “Noise filtering in atomistic stress calculations for crystalline materials.” *Journal of the Mechanics and Physics of Solids*, 144:104,083, 2020
- 13 Jaekwang Kim, Matt Jacobs, Stanley Osher, Nikhil Chandra Admal. “A crystal symmetry-invariant Kobayashi–Warren–Carter grain boundary model and its implementation using a thresholding algorithm.” *Computational Materials Science*, 199:110,575, 2021. ISSN 0927-0256
- 14 Junyan He, Nikhil Chandra Admal. “Polycrystal plasticity with grain boundary evolution: A numerically efficient dislocation-based diffuse-interface model.” *Modelling and Simulation in Materials Science and Engineering*, 30(2):025,006, 2021
- 15 Ganesh Ananthakrishnan, Mitisha Surana, Matthew Poss, Jad Jean Yaacoub, Kaihao Zhang, Nikhil Admal, Pascal Pochet, Sameh Tawfick, Harley T Johnson. “Graphene-mediated stabilization of surface facets on metal substrates.” *Journal of Applied Physics*, 130(16):165,302, 2021
- 16 Himanshu Joshi, Junyan He, Nikhil Chandra Admal. “A finite deformation theory for grain boundary plasticity based on geometrically necessary disconnections.” *Journal of the Mechanics and Physics of Solids*, p. 104949, 2022
- 17 Mitisha Surana, Tusher Ahmed, Nikhil Chandra Admal. “Interface mechanics of 2D materials on metal substrates.” *Journal of the Mechanics and Physics of Solids*, p. 104831, 2022
- 18 Nikhil Chandra Admal, Tusher Ahmed, Enrique Martinez, Giacomo Po. “Interface dislocations and grain boundary disconnections using Smith normal bicrystallography.” *Acta Materialia*, p. 118340, 2022

- 19 Jaekwang Kim, Nikhil Chandra Admal. “A stochastic framework for evolving grain statistics using a neural network model for grain topology transformations.” *Computational Materials Science*, 216:111,812, 2023
- 20 Mitisha Surana, Ganesh Ananthakrishnan, Matthew M Poss, Jad Jean Yaacoub, Kaihao Zhang, Tusher Ahmed, Nikhil Chandra Admal, Pascal Pochet, Harley T Johnson, Sameh Tawfick. “Strain-driven faceting of graphene-catalyst interfaces.” *Nano letters*, 23(5):1659–1665, 2023
- 21 Md. Tusher Ahmed, Chenhaoyue Wang, Amartya S Banerjee, Nikhil Chandra Admal. “Bicrystallography-informed Frenkel–Kontorova model for interlayer dislocations in strained 2D heterostructures.” <https://dx.doi.org/10.13140/RG.2.2.28770.91840>, 2023
- 22 Jaekwang Kim, Nikhil Chandra Admal. “Statistics of grain microstructure evolution under anisotropic grain boundary energies and mobilities using threshold-dynamics.” <http://dx.doi.org/10.13140/RG.2.2.22060.03201>, 2023

### **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
- 3 Junyan He, Nikhil Chandra Admal. “A study of the beveling instability in solenoid conductors.” *A report submitted to FermiLab, Batavia, Illinois*, 2020

### **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
- 3 “Bridging atomistic, mesoscale and continuum models for materials.” Department of Mechanical Engineering, University of Houston, Houston, TX, April 2016
- 4 “Grain growth in dynamic recrystallization.” Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA, March 2017
- 5 “Grain growth in dynamic recrystallization.” School of Engineering, Brown University, Providence, RI, March 2017
- 6 “Plasticity in extreme environments: Recrystallization and grain growth.” Department of Mechanical Engineering, State University of New York at Buffalo, Buffalo, NY, March 2018

- 7 “Plasticity in extreme environments: Recrystallization and grain growth.” Department of Mechanical Science and Engineering, University of Illinois at Urbana Champaign, Urbana-Champaign, IL, March 2018
- 8 “Plasticity in extreme environments: Recrystallization and grain growth.” Department of Materials Science and Engineering, University of Arizona, Tucson, Tucson, AZ, April 2018
- 9 “Plasticity in extreme environments: Recrystallization and grain growth.” Department of Mechanical and Aerospace Engineering, University of California, Irvine, Irvine, CA, April 2018
- 10 “Polycrystal plasticity with grain boundary evolution - a framework to model recovery, recrystallization and grain growth.” University of Minnesota, Oct 2019
- 11 “Polycrystal plasticity with anisotropic grain boundary evolution.” USACM Thematic Workshop on Recent Advances in the Modeling and Simulation of the Mechanics of Nanoscale Materials, University of Pennsylvania, PA, 2019
- 12 “Modeling 3-d grain boundary evolution driven by the five-dimensional grain boundary energy landscape.” Dislocations conference, Technion-Israel Institute of Technology, Haifa, Sep 2019
- 13 “Emergence of texture from grain boundary mechanics at the mesoscale.” Auburn University, Sep 2020
- 14 “Mechanics of interfaces.” Alumni Board Meeting, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, Mar 2021
- 15 “Geometric incompatibility and interface evolution in polycrystals and graphene-metal interfaces.” University of California Los Angeles, Apr 2021
- 16 “Continuum modeling of grain boundary plasticity - dislocations and disconnections.” 1<sup>st</sup> FRASCAL Virtual Colloquium, Friedrich-Alexander-Universität Erlangen-Nürnberg, Jul 2021
- 17 “Interface dislocations and grain boundary disconnections using smith normal bicrystallography.” University of Minnesota, Aug 2022
- 18 “Interface dislocations and grain boundary disconnections using smith normal bicrystallography.” Department of Mechanical and Aerospace Engineering, University of Colorado Colorado Springs, Sep 2022
- 19 “Characterizing interface dislocations in 2D heterostructures.” Society for Engineering Science, College Station, TX, October 2022
- 20 “Interface dislocations in grain boundaries and 2D heterostructures using Smith normal bicrystallography.” Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, March 2023

- 21 “Trends in shear coupling factors of asymmetric tilt grain boundaries: An examination of the disconnection model.” Cairo Symposium on the Physics of Plasticity, Cairo, Egypt, March 2023
- 22 “The Energetics of Disconnections in Grain Boundaries.” XVII International Conference on Computational Plasticity, Barcelona, Spain, September 2023

### **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 “A diffuse-interface elasto-plastic model to study grain boundary evolution.” 8th International Conference on Multiscale Materials Modeling, Dijon, France, October 2016
- 11 “Polycrystal plasticity with grain boundary evolution.” Centre Européen de Calcul Atomique et Moléculaire (CECAM), Lugano, Switzerland, February 2017
- 12 “A fast thresholding algorithm for the Kobayashi-Warren-Carter grain boundary model.” Society for Engineering Science, Sep 2020
- 13 “A disconnection-based diffuse-interface approach to model grain boundary motion.” United States National Conference on Computational Mechanics, Jul 2021

- 14 “Mesoscale modeling of facet formation in graphene-metal interfaces.” United States National Conference on Computational Mechanics, Jul 2021
- 15 “A thresholding method for the kobayashi–warren–carter grain boundary model with general mobilities.” United States National Conference on Computational Mechanics, Jul 2021
- 16 “A crystal plasticity framework to model continuum disconnections in polycrystals.” The Minerals, Metals and Materials Society, Anaheim, CA, Feb-Mar 2022
- 17 “Interface mechanics of 2d materials on metal substrates.” 19th U.S. National Congress of Theoretical and Applied Mechanics, Austin, TX, Jun 2022
- 18 “Interface dislocations and grain boundary disconnections using smith normal bicrystallography.” 10th International Conference on Multiscale Materials Modeling, Baltimore, MD, October 2022

### **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**

Journal Referee

**International Journal of Plasticity**

**Nano Letters, ACS Publications**

**Journal of Statistical Physics**

**Mechanics of Materials**

**Acta Materialia**

**Journal of Chemical Theory and Computation**

**Journal of Chemical Physics**

**Archive for Rational Mechanics and Analysis**

**Journal of Elasticity**

**Modeling and Simulation in Materials Science and Engineering**

**Physical Review E**

**Physical Letters A**

**Nuclear Inst. and Methods in Physics Research, B**

**International Journal of Solids and Structures**

**Fusion Science and Technology**  
**Journal of Mechanics and Physics of Solids**  
**Journal of Micromechanics and Microengineering**  
**Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences**  
**Crystal**  
**Metals**  
**Nuclear Fusion**

Technical Service and Conference Activities

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

MMM 2018        **Symposium co-organizer, Crystal plasticity and discrete defect mechanics**

SES 2020        **Scientific track co-chair, Advances in Nanomechanics**

SES 2020        **Symposium co-organizer, Grain boundary and Interfacial mechanics**

MMS 2021-      **Coordinator for the Midwest Mechanics Seminar series**

USNCCM 2021    **Symposium co-organizer, Computational methods for modelling stationary and non-stationary interfaces at multiple scales**

USACM 2021     **Virtual Workshop co-organizer, New Trends and Open Challenges in Computational Mechanics: from Nano to Macroscale**

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

2012–Present      **Contributor**

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

## **Software**

- 1 *MDStressLab version 2.0.0*, Released: September 2021. URL <https://github.com/nikhil-admal/mdstresslab>. N. C. Admal, M. Shi, E. B. Tadmor
- 2 *open Interface Lab (oILAB) version 1.0.0*, Released: September 2022. URL <https://github.com/oilab-project/oILAB>. N. C. Admal, G. Po

## **Relevant Skills**

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