Prashant K. Jha

Research Associate
POB 6.252
Oden Institute for Computational Engineering and Sciences
The University of Texas at Austin
Austin, TX, USA

https://prashjha.github.io/
pjha.sci@gmail.com
pjha@utexas.edu
Orcid: 0000-0003-2158-364X
+1-225-249-9456

(a) Research Interests

My research is driven by the application of mathematics and computational science to present-day relevant and challenging problems. Specific areas of interest include mechanics of solids and granular media, computational oncology, and multiscale modeling.

(b) Education

B.E. (2006 – 2010)   Mechanical Engineering, **Govt. Engineering College**, Raipur, India

M.E. (2010 – 2012)   Mechanical Engineering, **Indian Institute of Science**, Bangalore, India
Adviser: Dr. Chandrashekhar S. Jog

Ph.D. (2012 – 2016)   Civil and Environmental Engineering, **Carnegie Mellon University**, Pittsburgh, USA
Adviser: Dr. Kaushik Dayal

(c) Professional Experiences

Postdoctoral Fellow
Oct 2016 – Jul 2019
Department of Mathematics
Louisiana State University
PI: Dr. Robert Lipton

Peter O'Donnell
Postdoctoral Fellow
Aug 2019 – Nov 2020
Oden Institute for Computational Engineering and Sciences
The University of Texas at Austin
PI: Dr. J. Tinsley Oden

Research Associate
Dec 2020 – present
Oden Institute for Computational Engineering and Sciences
The University of Texas at Austin
PI: Dr. J. Tinsley Oden

(d) Teaching Experiences

1. **COE 311K**   Engineering Computation
   Fall 2021   Department of Aerospace Engineering and Engineering Mechanics
   The University of Texas at Austin

2. **BME 313L**   Introduction to Numerical Methods in Biomedical Engineering
   Fall 2021   Department of Biomedical Engineering
   The University of Texas at Austin

(e) Professional Responsibilities

Journal Editing

   1. **Associate Editor**   Journal of Peridynamics and Nonlocal Modeling (link)

Journal Reviews

   CMAME (12 reviews), JMPS (2 reviews), M3AS (1 review), JALCOM (1 review)

Activities

- Co-organized minisymposium M19 on "Nonlocal models in mathematics and computation" at SIAM TX-LA 3rd Annual Meeting. Oct 2020.
- One of the nominated candidate for the election of members-at-large for USACM TTA on Mathematical Methods. Jun 2021.

Mentoring

- Co-mentored a student working on the development of distributed solver for a nonlocal diffusion equation. Google Summer of Code 2020. Related github repository. Summer 2020.

(f) Grants

1. $50,000   A mechanistic tumor growth model for HP MRI
   In collaboration with MD Anderson Cancer Center, Houston, USA. Duration: Sep 2020 – Aug 2021

(g) Publications

Published

1. P. K. **Jha** and R. Lipton, "Finite element approximation of nonlocal dynamic fracture models," *Discrete & Continuous Dynamical Systems-B*, vol. 22, no. 11, p. 0, 2017.
2. P. K. **Jha** and R. Lipton, "Numerical analysis of nonlocal fracture models in holder space," *SIAM Journal on Numerical Analysis*, vol. 56, no. 2, pp. 906–941, 2018.
3. P. K. **Jha** and R. Lipton, "Numerical convergence of nonlinear nonlocal continuum models to local elastodynamics," *International Journal for Numerical Methods in Engineering*, vol. 114, no. 13, pp. 1389–1410, 2018.
4. P. Diehl, P. K. **Jha**, H. Kaiser, R. Lipton, and M. Lévesque, "An asynchronous and task-based implementation of peridynamics utilizing hpx—the c++ standard library for parallelism and concurrency," *SN Applied Sciences*, vol. 2, no. 12, pp. 1–21, 2020.
5. R. Lipton, E. Said, and P. K. **Jha**, "Free damage propagation with memory," *Journal of Elasticity*, vol. 133, no. 2, pp. 129–153, 2018.
6. R. P. Lipton, R. B. Lehoucq, and P. K. **Jha**, "Complex fracture nucleation and evolution with nonlocal elastodynamics," *Journal of Peridynamics and Nonlocal Modeling*, vol. 1, no. 2, pp. 122–130, 2019.
7. P. K. **Jha** and R. Lipton, "Numerical convergence of finite difference approximations for state based peridynamic fracture models," *Computer Methods in Applied Mechanics and Engineering*, vol. 351, pp. 184–225, 2019.
8. P. K. **Jha** and R. Lipton, "Finite element convergence for state-based peridynamic fracture models," *Communications on Applied Mathematics and Computation*, vol. 2, no. 1, pp. 93–128, 2020.
9. P. K. **Jha** and R. P. Lipton, "Kinetic relations and local energy balance for lefm from a nonlocal peridynamic model," *International Journal of Fracture*, vol. 226, no. 1, pp. 81–95, 2020.
10. P. K. **Jha**, L. Cao, and J. T. Oden, "Bayesian-based predictions of covid-19 evolution in texas using multispecies mixture-theoretic continuum models," *Computational Mechanics*, 2020.
11. P. K. **Jha**, P. S. Desai, D. Bhattacharya, and R. Lipton, "Peridynamics-based discrete element method (peridem) model of granular systems involving breakage of arbitrarily shaped particles," *Journal of the Mechanics and Physics of Solids*, vol. 151, p. 104376, 2021.
12. R. P. Lipton and P. K. **Jha**, "Nonlocal elastodynamics and fracture," *Nonlinear Differ. Equ. Appl. 28*, vol. 23, 2021.
13. M. Fritz, P. K. **Jha**, T. Köppl, J. T. Oden, and B. Wohlmuth, "Analysis of a new multispecies tumor growth model coupling 3d phase-fields with a 1d vascular network," *Nonlinear Analysis: Real World Applications*, vol. 61, p. 103331, 2021.
14. M. Fritz, P. K. **Jha**, T. Köppl, J. T. Oden, A. Wagner, and B. Wohlmuth, "Modeling and simulation of vascular tumors embedded in evolving capillary networks," *Computer Methods in Applied Mechanics and Engineering*, vol. 384, p. 113975, 2021.
15. D. A. Hormuth, C. M. Phillips, C. Wu, E. A. B. F. Lima, G. Lorenzo, P. K. **Jha**, A. M. Jarrett, J. T. Oden, and T. E. Yankeelov, "Biologically-based mathematical modeling of tumor vasculature and angiogenesis via time-resolved imaging data," *Cancers*, vol. 13, no. 12, 2021.
16. P. Gadikar, P. Diehl, and P. K. **Jha**, "Load balancing for distributed nonlocal models within asynchronous many-task systems," in *2021 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW)*, (Los Alamitos, CA, USA), pp. 669–678, IEEE Computer Society, jun 2021.

Under Review

17. P. K. **Jha**, T. Breitzman, and K. Dayal, "Discrete-to-continuum limits of long-range electrical interactions in nanostructures," *Preprint: https://www.math.cmu.edu/cna/Publications/publications2020/papers/20-CNA-020.pdf*, 2020.

Book Chapters & Reports

18. P. K. **Jha** and R. Lipton, *Well-posed nonlinear nonlocal fracture models associated with double-well potentials*, pp. 1–40. Cham: Springer International Publishing, 2018.
19. P. K. **Jha** and R. Lipton, *Finite differences and finite Eeements in nonlocal fracture modeling: A priori convergence rates*, pp. 1–38. Cham: Springer International Publishing, 2018.

20. R. Lipton, E. Said, and P. K. **Jha**, *Dynamic brittle fracture from nonlocal double-well potentials: A state-based model*, pp. 1–27. Cham: Springer International Publishing, 2018.
21. R. Lipton, E. Said, and P. K. **Jha**, *Dynamic damage propagation with memory: A state-based model*, pp. 1–29. Cham: Springer International Publishing, 2018.

(h) Major Projects

- **Development of tumor growth model for breast cancer.** Develop a multi-physics model of vascular tumor to determine the patient-specific optimal treatment plan. (In collaboration with the experts at UT Austin and Technical University of Munich).
- **Mechanistic model for HP MRI signal recovery.** Develop model for Hyperpolarized (HP) MRI and formulate optimal experimental design problem for MRI design parameters with uncertainty in the data and the model parameters. (In collaboration with experts at UT Austin and MD Anderson Cancer Center).
- **Peridynamics.** Develop and analyze peridynamics model of continuum solid. Applications include fracture, corrosion, and fatigue.
- **Granular media.** Application of recently proposed high-fidelity model for granular media. Focus includes: 1) understanding change in flow regime, 2) optimization of instruments (e.g., drilling), 3) development of multi-physics engine with applications such as simulation of rover, additive manufacturing process, etc.

(i) Open-sourced Software

- **PeriDEM.** Implementation of high-fidelity model (PeriDEM, JMPS 2021) of granular media.
- **NLMech.** Peridynamics simulation library. (With P. Diehl).
- **BayesForSEIRD.** Bayesian calibration and validation of the SEIRD epidemic model. (With L. Cao).
- **Angiogenesis3D1D.** Angiogenesis and tumor growth using 3D-1D model. (With T. Köppl, A. Wagner, M. Fritz).

(j) Talks

1. Seminar: *Coarse graining of electric field interactions with materials.* Mechanical Engineering Seminar, Indian Institute of Science, Bangalore, India. Aug 2016.
2. Seminar: *Coarse graining of electric field interactions with materials.* Mechanical Engineering Seminar, Indian Institute of Technology, Chennai, India. Aug 2016.
3. Seminar: *Coarse graining of electric field interactions with materials.* AEM Mechanics Research Seminar, University of Minnesota Twin Cities, Minneapolis, USA. Mar 2017.
4. Seminar: *Numerical analysis of nonlocal fracture models.* IMA Postdoctoral Seminar, University of Minnesota Twin Cities, Minneapolis, USA. Apr 2017.
5. Conference: *Numerical analysis of nonlocal fracture models.* US National Congress on Computational Mechanics USNCCM14, Montreal, Canada. Jul 2017.
6. Seminar: *Finite element approximation of nonlocal fracture models.* Mathematics Department Applied Analysis Seminar, Louisiana State University, Baton Rouge, USA. Mar 2018.
7. Seminar: *Well-posedness of nonlocal fracture models and apriori error estimates of numerical approximations.* Mathematics Department Seminar, Indian Institute of Science, Bangalore, India. May 2018.
8. Conference: *Free damage propagation with memory.* 13th World Congress in Computational Mechanics, New York, USA. Jul 2018.
9. Conference: *Convergence results for finite element and finite difference approximation of nonlocal fracture models.* SIAM TX-LA Annual Meeting, Baton Rouge, USA. Oct 2018.
10. Seminar: *Modelling fracture in solids using nonlocal interaction: A brief overview of Peridynamics.* Mechanical Engineering Seminar, Indian Institute of Technology, Delhi, India. Apr 2019.
11. Conference: *Convergence results for finite element and finite difference approximation of nonlocal fracture.* ICIAM 2019, Valencia, Spain. Jul 2019. Presented by Dr. R. Lipton.
12. Conference: *Numerical fracture experiments using nonlinear nonlocal models.* US National Congress on Computational Mechanics USNCCM15, Austin, USA. Jul 2019.
13. Informal seminar: *Numerical fracture experiments using nonlinear nonlocal models.* Oden Institute, The University of Texas at Austin, Austin, USA. Aug 2019.
14. Seminar: *A mechanistic tumor growth model for HP MRI.* Center for Computational Oncology Seminar, The

University of Texas at Austin, Austin, USA. Sep 2020.

15. Seminar: *A mechanistic tumor growth model for HP MRI.* Civil and Environmental Engineering Seminar, Carnegie Mellon University, Pittsburgh, USA. Oct 2020.

16. Seminar: *Application of peridynamics to fracture in solids and granular media.* Special Mechanics Seminar, University of Houston, Houston, USA. Oct 2020.

17. Conference: *Application of peridynamics to fracture in solids and granular media.* SIAM TX-LA Annual Meeting 2020, USA. Oct 2020.

18. Seminar: *Application of peridynamics to fracture in solids and granular media.* MAE Seminar Series, University at Buffalo, Buffalo, USA. Oct 2020.

19. Seminar: *Modeling failure in solids and tissue-scale tumour growth via high-fidelity computational methodologies.* Department Seminar, Department of Computational and Data Science, Indian Institute of Science, Bangalore, India. May 2021.

20. Conference: *Analysis and Application of Peridynamics to Fracture in Solids and Granular Media.* EMI 2021, USA. May 2021.

21. Conference: *Analysis and Application of Peridynamics to Fracture in Solids and Granular Media.* USNCCM 16, USA. Jul 2021.

(k) Awards & Achievements

- All India rank 31 (957/1000 score) in GATE-2010 exam, India (May 2010)
- Best Teaching Assistant award for the finite element methods course, CEE, CMU (May 2013)
- Peter O'Donnell Postdoctoral Fellowship, Oden Institute, UT Austin (Aug 2019)

(l) Key References

Dr. J. Tinsley Oden   **Professor**
Email: oden@oden.utexas.edu   POB 6.324
Website: https://jtoden.oden.utexas.edu/   The University of Texas at Austin
Phone: 512-471-3312   Austin, TX 78712

Dr. Robert Lipton   **Professor**
Email: lipton@lsu.edu   258 Lockett Hall
Website: https://www.math.lsu.edu/ lipton/   Louisiana State University
Phone: 225-578-1569   Baton Rouge, LA 70803

Dr. Kaushik Dayal   **Professor**
Email: Kaushik.Dayal@cmu.edu   123J Porter Hall
Website: https://sites.google.com/view/kaushik-dayal-research-group   Carnegie Mellon University
Phone: 412-268-2949   Pittsburgh, PA 15213

Dr. Chandrashekhar S. Jog   **Professor**
Email: jogc@iisc.ac.in   307 Mechanical Engineering Building
Website: http://www.mecheng.iisc.ac.in/users/jogc   Indian Institute of Science
Phone: +91-80-22932957   Bengaluru, India 560012