Prashant K. Jha

Ph.D.

Research interests

My research interests lie in the intersection of fracture mechanics, multiscale modelling and numerical analysis. I am motivated by application of mechanics and computation in modelling of complex, multi-physics, and multi-scale phenomenon. Current work involves application of Peridynamic theory in modelling fracture in solids.

Key areas of research

- Computational mechanics
- Fracture mechanics
- Multiscale modelling
- Numerical analysis

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b. Google website: google site
c. Git: https://github.com/prashjha
d. Orcid: https://orcid.org/0000-0003-2158-364X
e. Google scholar: link

Education

B.E. (2006 – 2010)

Mechanical Engineering
New Govt. Engineering College, Raipur (India)

M.E. (2010 – 2012)

Mechanical Engineering
Indian Institute of Science, Bengaluru (India)

Thesis: A monolithic strategy for fluid-structure interaction in compressible flow
Adviser: Dr. Chandrashekhar S. Jog

Ph.D. (2012 – 2016)

Civil and Environmental Engineering
Carnegie Mellon University, Pittsburgh (USA)

Thesis: Coarse graining of electric field interactions with materials
Adviser: Dr. Kaushik Dayal

Work experience

Postdoctoral research
October 2016 – August 2019

Mathematics
Louisiana State University, Baton Rouge (USA)

Project: Numerical analysis of nonlocal fracture models
Adviser: Dr. Robert Lipton

Description: The work involved the numerical analysis of nonlocal fracture models referred to as Peridynamic theory. We have shown well-posedness of solutions and proved apriori convergence of the finite difference and the finite element approximation. For the numerical validation we have developed a computational code for both finite difference discretization and finite element discretization. Another aspect of work has been to propose and study new models in the nonlocal framework. At present we are working on validation of the Peridynamics models and the coupling of nonlocal and local theory for computational efficiency.

Peter O'Donnell Postdoctoral Fellowship (To begin)
September 2019 – August 2020

Oden Institute for Computational Engineering and Sciences
The University of Texas at Austin, Austin (USA)

Adviser: Dr. J. Tinsley Oden

Refereed journal publications

1. Numerical analysis of nonlocal fracture models in Hölder space. Prashant K. Jha and Robert Lipton.
   - Submitted Jan 2017, published April 2018. https://doi.org/10.1137/17M1112236
   - SIAM Journal on Numerical Analysis, 10 April 2018, 56(2), 906-941

2. Numerical convergence of nonlinear nonlocal continuum models to local elastodynamics. Prashant K. Jha and Robert Lipton.
   - Submitted July 2017, published March 2018. https://doi.org/10.1002/nme.5791
   - International Journal for Numerical Methods in Engineering, 19 February 2018, 114(13), 1389-1410

3. Free damage propagation with memory. Robert Lipton, Eyad Said, and Prashant K. Jha.
   - Submitted July 2017, published March 2018. https://doi.org/10.1007/s10659-018-9672-7
   - Journal of Elasticity, 14 March 2018, 133(2), 129-153

4. Finite element approximation of nonlocal fracture models. Prashant K. Jha and Robert Lipton.
   - Submitted May 2019. arXiv preprint: https://arxiv.org/abs/1710.07661
   - **Under review** in Discrete and Continuous Dynamical Systems Series B

5. Numerical convergence of finite difference approximations for state based peridynamic fracture models. Prashant K. Jha and Robert Lipton.
   - Submitted August 2018, published March 2018. https://doi.org/10.1016/j.cma.2019.03.024
   - Computer Methods in Applied Mechanics and Engineering, 1 July 2019, 351(1), 184 – 225

6. Implementation of Peridynamics utilizing HPX – the C++ standard library for parallelism and concurrency. Patrick Diehl, Prashant K. Jha, Hartmut Kaiser, Robert Lipton, and Martin Levesque.
   - Submitted April 2019. arXiv preprint: https://arxiv.org/abs/1806.06917
   - **Under review** in Computer and Mathematics with Applications

7. Finite element convergence for state-based peridynamic fracture models. Prashant K. Jha and Robert Lipton.
   - Submitted September 2018, accepted May 2019. arXiv preprint: https://arxiv.org/abs/1903.00924
   - Communication on Applied Mathematics and Computation (CAMC)

8. Complex fracture nucleation and evolution with nonlocal elastodynamics. Robert Lipton, Richard B. Lehoucq, and Prashant K. Jha.
   - Submitted December 2018, published April 2019. https://doi.org/10.1007/s42102-019-00010-0
   - Journal of Peridynamics and Nonlocal Modelling, April 2019, 1 – 9

Book chapters

1. Well posed nonlinear nonlocal fracture models associated with double well potentials. Prashant K. Jha and Robert Lipton. Handbook of Nonlocal Continuum Mechanics for Materials and Structures. Link: https://doi.org/10.1007/978-3-319-22977-5_40-1

2. Finite difference and finite element in nonlocal fracture modeling: A-priori convergence rates. Prashant K. Jha and Robert Lipton. Handbook of Nonlocal Continuum Mechanics for Materials and Structures. Link: https://doi.org/10.1007/978-3-319-22977-5_44-1

3. Dynamic brittle fracture from non-local double well potentials: A state-based model. Robert Lipton, Eyad Said, and Prashant K. Jha. Handbook of Nonlocal Continuum Mechanics for Materials and Structures. Link: https://doi.org/10.1007/978-3-319-22977-5_33-1

4. Dynamic damage propagation with memory: A state-based model. Robert Lipton, Eyad Said, and Prashant K. Jha. Handbook of Nonlocal Continuum Mechanics for Materials and Structures. Link: https://doi.org/10.1007/978-3-319-22977-5_45-1

Current work

- Nodal finite element approximation of nonlocal fracture models. Prashant K. Jha, Patrick Diehl, and Robert Lipton.
- Small horizon limit of state based peridynamic. Prashant K. Jha and Robert Lipton.
- Continuum limits of geometrically-complex nanostructures with electrical interactions. Prashant K. Jha and Kaushik Dayal.
- Coarse graining of electrostatic interaction in random media and its application in Quasicontinuum method. Prashant K. Jha and Kaushik Dayal.

Professional activity

Summer school **May 30 – June 7 (2013)**	Center for nonlinear analysis summer school Carnegie Mellon University, Pittsburgh, USA
Conference **June 7 – June 12 (2013)**	SIAM Mathematical Aspects of Material Science (MS13) Philadelphia, USA
Summer school **July 18 – July 21 (2014)**	PCMI summer school on Mathematics and Materials Park City Math Institute, Park City, USA
Research talk (Departmental Seminar) **August 19 (2016)**	Department of Mechanical Engineering Indian Institute of Science, Bengaluru, India Title: Coarse graining of electric field interactions with materials
Research talk (Departmental Seminar) **August 19 (2016)**	Department of Mechanical Engineering Indian Institute of Technology, Chennai, India Title: Coarse graining of electric field interactions with materials
Short-term Visit **February 2 – June 2 (2017)**	Institute for Mathematics and its Applications University of Minnesota, Minneapolis, USA
Research talk (Departmental Seminar) **March 21 (2017)**	AEM Mechanics Research Seminar Department of Aerospace Engineering and Mechanics University of Minnesota, Minneapolis, USA Title: Coarse graining of electric field interactions with materials
Research talk (IMA Postdoc Seminar) **April 4 (2017)**	Institute for Mathematics and its Applications University of Minnesota, Minneapolis, USA Title: Numerical analysis of nonlocal fracture models
Research talk (Conference) **July 19 (2017)**	14th US National Congress on Computational Mechanics conference July 17 – July 20 (2017) Montreal, Canada Title: Numerical analysis of fracture evolution using nonlocal fracture models

Research talk (Applied Analysis Seminar) March 19 (2018)	Department of Mathematics Louisiana State University, Baton Rouge, USA Title: Numerical analysis of finite element approximation of nonlocal fracture models
Research talk (Departmental Seminar) May 1 (2018)	Department of Mathematics Indian Institute of Science, Bengaluru, India Title: Well-posedness of nonlocal fracture models and apriori error estimates of numerical approximation
Research talk (Conference) July 25 (2018)	13th World Congress on Computational Mechanics conference July 22 – July 27 (2018) New York, USA Title: Free damage propagation with memory

Skills and experience

- Programming languages: C, C++, Python, Matlab (Octave), Linux shell
- Parallel computing using pthread and HPX
- Experience of collaboration on Github and developing open source library

TA experience

- Teaching assistant for graduate level course finite element methods**.** Three times from 2013 – 2016.
- Teaching assistant for graduate level course special topics: computational materials modelling for structures.

Group affiliations

- Member of Society for Industrial and Applied Mathematics (SIAM).
- Member of United States Association for Computational Mechanics (USACM).

Awards and achievements

- GATE Exam: All India rank 31 in GATE-2010.
- Dean's fellowship (for 1st year of Ph.D.) at Civil Engineering Department, Carnegie Mellon University.
- Best Teaching Assistant award for finite element methods (May 2013).
- Peter O'Donnell, Jr. Postdoctoral Fellowship for September 2019 – August 2020 at University of Texas at Austin.

References

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