PRASHANT K. JHA

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My research interests include computational modeling, computational oncology, continuum and fracture mechanics, and numerical analysis. I am interested in application of mathematical models and high-performance computational resources to key and present-day relevant problems.

EXPERIENCE

2020-09-16 – PRESENT
POSTDOCTORAL SCHOLAR, THE UNIVERSITY OF TEXAS AT AUSTIN

Department: Oden Institute for Computational Engineering and Sciences
Work description: Perform research, present work in seminar and conference, collaborate and exchange ideas, write proposals.

2019-08-01 – 2020-09-15
POSTDOCTORAL SCHOLAR, THE UNIVERSITY OF TEXAS AT AUSTIN

Department: Oden Institute for Computational Engineering and Sciences
Adviser: Dr. J. Tinsley Oden
Work description: Perform research, present work in seminar and conference, collaborate and exchange ideas, write proposals.

2016-10-01 – 2019-07-31
POSTDOCTORAL SCHOLAR, LOUISIANA STATE UNIVERSITY

Department: Department of Mathematics
Adviser: Dr. Robert Lipton
Work description: Perform research, present work in seminar and conference, collaborate and exchange ideas, write proposals.

EDUCATION

2012-08-01 – 2016-09-07
PhD, CARNEGIE MELLON UNIVERSITY

Department: Civil and Environmental Engineering
Adviser: Dr. Kaushik Dayal
Project: Coarse graining of electric field interactions with materials

2010-08-01 – 2012-06-30
ME, INDIAN INSTITUTE OF SCIENCE, BANGALORE

Department: Mechanical Engineering
Adviser: Dr. C. S. Jog
Project: A monolithic strategy for fluid-structure interaction in compressible flow

2006-08-01 – 2010-06-30
BE, NEW GOVERNMENT ENGINEERING COLLEGE, RAIPUR
Department: Mechanical Engineering

MAJOR PROJECTS

2020-09-01 – PRESENT
A MECHANISTIC TUMOR GROWTH MODEL FOR HP MRI

- HP MRI techniques show tremendous potential for identification of tumor legions in a patient. Currently, ODE-based compartmental models are utilized to recover the signal from the imaging data. In this project, we consider a 1D-3D PDE-based model which explicitly accounts for heterogeneous flow in the tissue due to vasculature.
- This is supported by a pilot project grant under the joint initiative of Oden institute-MD Anderson-TACC.
- In collaboration with Dr. J. T. Oden (UT Austin) and Dr. D. Fuentes (MD Anderson Cancer Center)

2020-01-01 – PRESENT
APPLICATION OF PHYSICS-INFORMED NEURAL NETWORK TO TUMOR GROWTH

- Our objective in this project is to find the scenarios where Physics-informed neural networks (PINNs) can be applied to study and better understanding of the tumor growth in the tissue.
- In collaboration with Dr. J. T. Oden (UT Austin)

2019-08-01 – PRESENT
DEVELOPMENT OF MODELS OF TUMOR GROWTH

- In this project, we aim to develop a realistic simulator of growth/decline of tumor in cancerous tissue. This has two major applications: 1. Testing various treatment hypothesis, and 2. Recovery of information from the imaging data. Towards this, we have proposed a 3D-1D model that couples the flow of blood and substances in the vessels to the constituents in the tissue.
- In collaboration with Dr. J. T. Oden (UT Austin) and researchers at Technical University of Munich

2016-10-01 – PRESENT
NUMERICAL ANALYSIS AND APPLICATION OF PERIDYNAMICS MODELS

- Peridynamics is a reformulation of classical continuum mechanics that has shown good success in describing the fracture in solids in a unified way. Aims of the project include numerical analysis of peridynamic models, application of the models, and study of the hidden properties of peridynamics and its relationship with the classical theory of fracture (LEFM).
- In collaboration with Dr. Robert Lipton and Dr. Patrick Diehl at Louisiana State University

2019-08-01 – PRESENT
DEVELOPMENT OF MASSIVELY PARALLEL LIBRARY FOR PERIDYNAMICS

- Together with Dr. P. Diehl at LSU, we are working on development of efficient and massively parallel library for peridynamics simulations.

- Towards this goal, we recently concluded a 3-4 months long Google Summer of Code 2020 event in which we introduced and mentored a project entitled "Domain decomposition, load balancing, and massively parallel solvers for the class of nonlocal models".

REFEREED JOURNAL PUBLICATIONS
*Under review, †book chapter

[2020-6]
Kinetic relations and local energy balance for LEFM from a nonlocal peridynamic model
Prashant K Jha and Robert Lipton
International Journal of Fracture, 5 September 2020, Link

[2020-5]
Bayesian-based predictions of COVID-19 evolution in Texas using multispecies mixture-theoretic continuum models
Prashant K Jha, Lianghao Cao, and J. Tinsley Oden
Computational Mechanics, 31 July 2020, Link

[2020-4]*
Plane elastodynamic solutions for running cracks as the limit of double well nonlocal dynamics
Robert Lipton and Prashant K Jha
arXiv:2001.00313 (under review July 2020), Link

[2020-3]
Finite element convergence for state-based peridynamic fracture models
Prashant K Jha and Robert Lipton
Communications on Applied Mathematics and Computation, March 2020, 2, 93-128, Link

[2020-2]*
Analysis of a new multispecies tumor growth model coupling 3D phase-fields with a 1D vascular network
Marvin Fritz, Prashant K Jha, Tobias Köppl, J Tinsley Oden, Barbara Wohlmuth
arXiv:2006.10477 (under review June 2020), Link

[2020-1]
Finite element approximation of nonlocal dynamic fracture models
Prashant K Jha and Robert Lipton
Discrete & Continuous Dynamical Systems - B, June 2020, 22, Link

[2019-2]
Numerical convergence of finite difference approximations for state based peridynamic fracture models
Prashant K Jha and Robert Lipton
Computer Methods in Applied Mechanics and Engineering, 21 March 2019, 351, 184-225, Link

[2019-1]
Complex fracture nucleation and evolution with nonlocal elastodynamics
Robert Lipton, Richard B Lehoucq, and Prashant K Jha
Journal of Peridynamics and Nonlocal Modeling, 25 April 2019, 1, 122-130, Link

[2018-8]† **Well-Posed Nonlinear Nonlocal Fracture Models Associated with Double-Well Potentials**
Prashant K Jha and Robert Lipton
In: Voyiadjis G. (eds) Handbook of Nonlocal Continuum Mechanics for Materials and Structures, 26 April 2018, 1-40, Link

[2018-7]† **Finite difference and finite element in nonlocal fracture modeling: A-priori convergence rates**
Prashant K Jha and Robert Lipton
In: Voyiadjis G. (eds) Handbook of Nonlocal Continuum Mechanics for Materials and Structures, 18 May 2018, 1-38, Link

[2018-6]† **Dynamic brittle fracture from non-local double well potentials: A state-based model**
Robert Lipton, Eyad Said, and Prashant K. Jha
In: Voyiadjis G. (eds) Handbook of Nonlocal Continuum Mechanics for Materials and Structures, 12 March 2018, 1-27, Link

[2018-5]† **Dynamic damage propagation with memory: A state-based model**
Robert Lipton, Eyad Said, and Prashant K. Jha
In: Voyiadjis G. (eds) Handbook of Nonlocal Continuum Mechanics for Materials and Structures, 16 March 2018, 1-29, Link

[2018-4] **Numerical convergence of nonlinear nonlocal continuum models to local elastodynamics**
Prashant K Jha and Robert Lipton
International Journal for Numerical Methods in Engineering, 24 May 2018, 114(13), 1389-1410, Link

[2018-3] **Numerical analysis of nonlocal fracture models in Hölder space**
Prashant K Jha and Robert Lipton
SIAM Journal on Numerical Analysis, 10 April 2018, 56(2), 906-941, Link

[2018-2]* **Implementation of Peridynamics utilizing HPX--the C++ standard library for parallelism and concurrency**
Patrick Diehl, Prashant K Jha, Hartmut Kaiser, Robert Lipton, Martin Levesque
arXiv:1806.06917 (Under review), Link

[2018-1] **Free damage propagation with memory**
Robert Lipton, Eyad Said, and Prashant K. Jha
Journal of Elasticity, 14 March 2018, 133(2), 129-153, Link

PROFESSIONAL ACTIVITY

2020-10-09, SEMINAR, CARNEGIE MELLON UNIVERSITY, PITTSBURGH
Department: Civil and Environmental Engineering
Title: A mechanistic tumor growth model for HP MRI

2020-09-16, SEMINAR, THE UNIVERSITY OF TEXAS AT AUSTIN, AUSTIN
Department: Oden Institute for Computational Engineering and Sciences

Title: A mechanistic tumor growth model for HP MRI

2019-08-20, SEMINAR, THE UNIVERSITY OF TEXAS AT AUSTIN, AUSTIN
Department: Oden Institute for Computational Engineering and Sciences
Title: Numerical fracture experiments using nonlinear nonlocal models

2019-08-20, **CONFERENCE**, US NATIONAL CONGRESS ON COMPUTATIONAL MECHANICS 15**,** AUSTIN
Title: Numerical fracture experiments using nonlinear nonlocal models

2019-07-17, **CONFERENCE**, ICIAM 2019, VALENCIA
Title: Convergence results for finite element and finite difference approximation of nonlocal fracture

2019-04-12, SEMINAR, INDIAN INSTITUTE OF TECHNOLOGY, DELHI
Department: Mechanical Engineering
Title: Modelling fracture in solids using nonlocal interaction: A brief overview of Peridynamics

2018-10-06, **CONFERENCE**, SIAM TX LA MEETING 2018, BATON ROUGE
Title: Convergence results for finite element and finite difference approximation of nonlocal fracture models

2018-07-25, **CONFERENCE**, WORLD CONGRESS ON COMPUTATIONAL MECHANICS 13**,** NEWYORK
Title: Free damage propagation with memory

2018-05-01, SEMINAR, INDIAN INSTITUTE OF SCIENCE, BANGALORE
Department: Department of Mathematics
Title: Well-posedness of nonlocal fracture models and apriori error estimates of numerical approximations

2018-03-19, SEMINAR, LOUISIANA STATE UNIVERSITY, BATON ROUGE
Department: Department of Mathematics
Title: Finite element approximation of nonlocal fracture models

2017-07-19, **CONFERENCE**, US NATIONAL CONGRESS ON COMPUTATIONAL MECHANICS 14**,** MONTREAL
Title: Numerical Analysis of Nonlocal Fracture Models

2017-04-04, SEMINAR, UNIVERSITY OF MINNESOTA TWIN CITIES, MINNEAPOLIS
Department: Institute for Mathematics and its Applications
Title: Numerical Analysis of Nonlocal Fracture Models

2017-04-04, SEMINAR, UNIVERSITY OF MINNESOTA TWIN CITIES, MINNEAPOLIS
Department: Aerospace Engineering and Mechanics
Title: Coarse Graining of Electric Field Interactions with Materials

2016-08-22, SEMINAR, INDIAN INSTITUTE OF TECHNOLOGY, MADRAS
Department: Mechanical Engineering
Title: Coarse Graining of Electric Field Interactions with Materials

2016-08-19, SEMINAR, INDIAN INSTITUTE OF SCIENCE, BANGALORE

Department: Mechanical Engineering
Title: Coarse Graining of Electric Field Interactions with Materials

PROPOSALS AND GRANTS

2020-09-01 – 2021-08-31
A MECHANISTIC TUMOR GROWTH MODEL FOR HP MRI
Description: Awarded under the joint initiative of Oden Institute-MDACC-TACC

GROUP AFFILIATIONS

- SIAM
- USACM

AWARDS AND ACHIEVEMENTS

- GATE Exam: All India rank 31 in GATE-2010
- Best TA award for finite element methods (May 2013)
- Dean's fellowship (for 1st year of PhD)

REFERENCES

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