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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

2020-11-23 – PRESENT

RESEARCH ASSOCIATE, 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.

2019-08-01 – 2020-11-22

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) and Lianghao Cao (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

2020-09-01 – PRESENT

APPLICATION OF TUMOR GROWTH MODELS TO BREAST CANCER

- With experts at Center for Computational Oncology at Oden Institute, we are working towards development of models of tumor growth for breast cancer. One of the objectives is to calibrate the model and perform model selection using real patient data. We are also interested in application of model to understand effects of drugs on tumor growth and angiogenesis. In this collaboration we are considering dimensionally coupled model of flow in tissue and vessels. The vasculature in the model is based on real data and allows one to capture the flow heterogeneity in tissue more accurately.

REFEREED JOURNAL PUBLICATIONS

*Under review, †book chapter

- [2020-7]* **Peridynamics-based discrete element method (PeriDEM) model of granular systems involving breakage of arbitrarily shaped particles**
Prashant K Jha, Prathamesh S Desai, Debdeep Bhattacharya, and Robert Lipton
arXiv:2010.07218 (under review November 2020), [Link](#)
- [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

2020-10-22, **SEMINAR**, UNIVERSITY AT BUFFALO, BUFFALO
 Department: Department of Mechanical and Aerospace Engineering
 Title: Application of peridynamics to fracture in solids and granular media

2020-10-17, **CONFERENCE**, SIAM TX-LA 3RD ANNUAL MEETING, COLLEGE STATION
 Title: Application of peridynamics to fracture in solids and granular media

2020-10-16, SEMINAR, UNIVERSITY OF HOUSTON, HOUSTON

Department: Mechanical Engineering

Title: Application of peridynamics to fracture in solids and granular media

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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