

# Xiaoxuan Zhang, PhD

Postdoctoral Research Fellow  
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## EDUCATION

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- 04/2013-01/2018 **PhD**, Civil and Environmental Engineering  
Stanford University, USA
- 10/2009-01/2012 **MSc**, Computational Mechanics of Materials and Structures  
University of Stuttgart, Germany
- 08/2005-07/2009 **BE**, Mechanical Engineering  
Harbin Institute of Technology, China

## EMPLOYMENT

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- 04/2019-now **Postdoctoral Research Fellow**, Mechanical Engineering  
University of Michigan, Ann Arbor, USA
- 01/2018-03/2019 **Postdoctoral Scholar**, Civil and Environmental Engineering  
Stanford University, USA
- 10/2011-03/2013 **Research Assistant**, Institute of Applied Mechanics  
University of Stuttgart, Germany

## RESEARCH INTERESTS

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My research interest lies in understanding and optimizing material behaviors based on their microstructures by designing accurate, robust, and efficient data-driven/multiphysics/multiscale computational models. It can be categorized into three main areas: (i) understanding complex physical phenomena, (ii) developing novel numerical algorithms and tools, and (iii) addressing critical challenges from practical applications.

- Phenomena • Plasticity • Fracture • Growth • Solid Diffusion • Self-healing • Electro-Chemo-Thermo-Mechanical Coupling • Heat Transfer • Phase Transformation
- Algorithms • High Performance Computing • Machine Learning • Optimization • Uncertainty Quantification • Multiscale Modeling • Inverse Modeling
- Applications • Rechargeable Batteries • Additive Manufacturing • Biological Materials

## AWARDS

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- 2021 Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering & Technology (MMLDT-CSET) Conference NSF fellowship
- 2021 USNCCM16 Conference Award, International Association for Computational Mechanics
- 2019 NSF Student Travel Grant for 7th Annual MVAPICH User Group (MUG) Meeting
- 2016 Student Travel Award (WCCM XII), International Association for Computational Mechanics

- 2015 Best Student Paper Award (IMECE 2015), ASME–Applied Mechanics Division
- 2015 Student Travel Award (IMECE 2015), ASME–Applied Mechanics Division
- 2013-2015 James Monroe Gere Research Fellowship, Stanford University
- 2011 Honor Roll Students, COMMAS Program, University of Stuttgart
- 2010 DAAD Scholarship, German Academic Exchange Service
- 2009 Outstanding Graduates, Harbin Institute of Technology
- 2008-2009 SME Stipend, Harbin Institute of Technology
- 2008 Kwang-Hua Scholarship, Kwang-Hua Education Foundation
- 2007-2008 National Endeavor Scholarship, Chinese Minister of Education
- 2006-2008 People’s Scholarship, Harbin Institute of Technology

## PUBLICATIONS

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### Journal Articles in Progress

- P1. [Submitted] **X Zhang**, K Garikipati. (2021) *Bayesian neural networks for weak solution of PDEs with uncertainty quantification*.

(\* equal contribution)

### Peer-Reviewed Journal Articles

- J13. D Auddya\*, **X Zhang**\*, R Gulati, R Vasan, K Garikipati, P Rangamani, S Rudraraju. (2021) *Biomembranes undergo complex, non-axisymmetric deformations governed by Kirchhoff-Love kinematics and revealed by a three dimensional computational framework*, Proc. Math. Phys. Eng. Sci., accepted
- J12. Z Wang, M Carrasco-Teja, **X Zhang**, G H Teichert, K Garikipati. (2021) *System inference via field inversion for the spatio-temporal progression of infectious diseases: Studies of COVID-19 in Michigan and Mexico*, Arch. Comput. Methods Eng., accepted.
- J11. **X Zhang**, M Klinsmann, S Chumakov, X Li, S U Kim, M Metzger, M Besli, R Klein, C Linder, J Christensen. (2021) *A modified electrochemical model to account for mechanical effects due to lithium intercalation and external pressure*, J. Electrochem. Soc., 168:020533. ([link](#))
- J10. **X Zhang**, S Chumakov, X Li, M Klinsmann, S U Kim, C Linder, J Christensen. (2020) *An electrochemo-thermo-mechanical coupled three-dimensional computational framework for lithium-ion batteries*, J. Electrochem. Soc., 167:160542. ([link](#))
- J9. Z Wang, **X Zhang**, G H Teichert, M Carrasco-Teja, K Garikipati (2020). *System inference for the spatio-temporal evolution of infectious diseases: Michigan in the time of COVID-19*, Computational Mechanics, 66:1153-1176. ([link](#))
- J8. **X Zhang**, K Garikipati (2020). *Machine learning materials physics: Multi-resolution neural networks learn the free energy and nonlinear elastic response of evolving microstructures*, Comput. Meth. Appl. Mech. Eng., 372:113362. ([link](#))
- J7. T Jin, H Mourad, C Bronkhorst, V Livescu, **X Zhang**, C Linder, R Regueiro (2019). *Three-dimensional explicit finite element formulation for shear localization with global tracking of embedded weak discontinuities*. Comput. Meth. Appl. Mech. Eng., 353:416-447. ([Link](#))
- J6. **X Zhang**, R Klein, A Subbaraman, S Chumakov, X Li, J Christensen, C Linder, S U Kim (2019). *Evaluation of convective heat transfer coefficient and specific heat capacity of a lithium-ion battery using infrared camera and lumped capacitance method*. J. Power Sources., 412:552-558. ([Link](#)).
- J5. T Han, **X Zhang**, J Kim, S Chung, J Lim, C Linder, (2018). *Area of lineal-path function for describing pore microstructures of cement paste and relations to mechanical properties simulated from  $\mu$ -CT microstructures*. Cem. Concr. Compos., 89:1-17. ([Link](#)).

- J4. **X Zhang**, A Krischok, C Linder, (2016). *A variational framework to model diffusion induced large plastic deformation and phase field fracture during initial two-phase lithiation of silicon electrodes*. Comput. Meth. Appl. Mech. Eng., 312:51-77. ([Link](#)).
- J3. **X Zhang**, SW Lee, HW Lee, Y Cui, C Linder, (2015). *A reaction-controlled diffusion model for the lithiation of silicon in lithium-ion batteries*, Extreme Mechanics Letters, 4:61-75. ([Link](#)).
- J2. C Linder, **X Zhang**, (2014). *Three-dimensional finite elements with embedded strong discontinuities to model failure in electromechanical coupled materials*, Comput. Meth. Appl. Mech. Eng., 273:143-160. ([Link](#)).
- J1. C Linder, **X Zhang**, (2013). *A marching cubes based failure surface propagation concept for three-dimensional finite elements with non-planar embedded strong discontinuities of higher order kinematics*, Int. J. Numer. Meth. Eng., 96(6):339-372. ([Link](#)).

## PRESENTATIONS

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### Invited Presentations

3. **X Zhang**, *Computational modeling of lithium-ion batteries*, Lawrence Berkeley National Laboratory (invited by Dr. A. Weber), USA, December 19, 2017.
2. **X Zhang**, *A phase field approach to model electro-chemo-mechanical coupled fracture in lithium-ion batteries*, Department of Engineering Mechanics, Tsinghua University (invited by Dr. Z. Liu), China, August 17, 2016.
1. **X Zhang**, *New three-dimensional finite elements with non-planar embedded strong discontinuities*, Ukrainian Student Excursion Program, Stuttgart University (invited by Dr. M. Tkachuk), Germany, July 12, 2012.

### Conference Keynote Presentations

3. **X Zhang**, K Garikipati. *Bayesian neural networks for weak solution of PDEs with uncertainty quantification*, USNCCM 16, Chicago, Illinois, USA, July 25 - 29, 2021 (**conference award**).
2. **X Zhang**, Y Qiu, S Chumakov, X Li, M Klinsmann, S-U Kim, J Christensen, C Linder. *A multi-physics model for understanding the impact of mechanical constraints in lithium-ion batteries*, SES 2019, Washington University in St. Louis, USA, October 13-15, 2019.
1. C Linder, **X Zhang**. *Modeling diffusion induced fracture in silicon electrodes through a phase field approach*, ECCOMAS Congress 2016, Crete Island, Greece, June 5-10, 2016.

### Conference Presentations

18. **X Zhang**, K Garikipati. *Bayesian neural networks for weak solution of PDEs with uncertainty quantification*, MMLDT-CSET 2021, San Diego, CA, USA, September 26 - 29, 2021 (**conference NSF fellowship**).
17. D Auddya, **X Zhang**, R Gulati, R Vasan, P Rangamani, K Garikipati, S Rudraraju. *Biomembranes Undergo Complex, Non-Axisymmetric Deformations Governed by Kirchhoff-Love Kinematics and Revealed by a Three-Dimensional Computational Framework*, USNCCM 16, Chicago, Illinois, USA, July 25 - 29, 2021
16. **X Zhang**, K Garikipati. *Bayesian neural networks for weak solution of PDEs with uncertainty quantification*, EMI/PMC 2021 Conference (Hosted by Columbia University), May 25-28, 2021.
15. **X Zhang**, K Garikipati. *Machine learning material physics: A data-driven approach for predicting effective material properties in multi-component crystalline solids*, USNCCM 15, Austin, Texas, USA, July 28 - August 1, 2019.
14. **X Zhang**, K Garikipati. *Prediction of effective material properties in multi-component crystalline solids with a data-driven approach*, PACAM XVI, Ann Arbor, Michigan, USA, May 19-23, 2019.

13. **X Zhang**, X Li, S. Chumakov, S. U. Kim, M. Klinsmann, J. Christensen, C Linder. *Thermal-mechanical-electrochemical coupling simulation for electric vehicle batteries*, 233rd ECS Meeting, Seattle, USA, May 13-17, 2018.
12. **X Zhang**, C Linder. *Computational modeling of the formation and mechanical instability of solid electrolyte interphase on silicon electrodes in lithium-ion batteries*, USNCCM 14, Montreal, Canada, July 17-20, 2017.
11. **X Zhang**, C Linder. *A phase field approach to model electro-chemo-mechanical coupled fracture in lithium-ion batteries*, WCCM XII & APCOM VI 2016, Seoul, Korea, July 24-29, 2016 (**travel award**).
10. C Linder, **X Zhang**. *A phase field model for diffusion induced fracture in lithium-ion batteries*, EMI 2016, Vanderbilt University, Nashville, United States, May 22-25, 2016.
9. **X Zhang**, C Linder. *Investigation of diffusion induced fracture in silicon electrodes using a phase field model approach*, ASME 2015, International Mechanical Engineering Congress & Exposition, Houston, United States, November 13-19, 2015 (**travel award and best paper award**).
8. C Linder, **X Zhang**. *Phase field modeling of diffusion induced fracture in silicon electrodes*, USNCCM13, San Diego, United States, July 26-30, 2015.
7. Han T, **X Zhang**, Chung S, C Linder. *Phase field fracture modeling of microstructures with random spherical void distribution*, USNCCM13, San Diego, United States, July 26-30, 2015.
6. **X Zhang**, C Linder. *Phase field modeling of diffusion and fracture of silicon electrodes in lithium-ion batteries*, Engineering Mechanics Institute Conference (EMI2015), Stanford, June 16-19, 2015.
5. **X Zhang**, C Linder. *Phase field modeling of fracture in Si electrodes at large deformation*, 4th International Conference on Material Modeling (ICMM4), Berkeley, California, May 27-29, 2015.
4. **X Zhang**, C Linder. *Phase field modeling of diffusion and fracture in lithium-ion batteries*, SES 51st annual technical meeting, Purdue University, Oct 1-3, 2014.
3. **X Zhang**, C Linder. *A marching-cubes based crack propagation concept to model failure in three-dimensional solids*, 12th U.S. National Congress on Computational Mechanics(USNCCM12), Raleigh, North Carolina, July 22-25, 2013.
2. C Linder, **X Zhang**. *A marching cubes based failure surface propagation concept for 3D finite elements with non-planar embedded strong discontinuities*, ECCOMAS 2012, Vienna, Austria, September 10-14, 2012.
1. **X Zhang**, C Linder. *New three-dimensional finite elements with embedded strong discontinuities to model solids at failure*, 83rd Annual Scientific Conference of the International Association of Applied Mathematics and Mechanics (GAMM), Darmstadt, Germany, March 26-30, 2012.

## Poster Presentations

4. **X Zhang**, K Garikipati. *Bayesian Neural Networks for Weak Solution of PDEs with Uncertainty Quantification*, Machine Learning in Science & Engineering 2020, Hosted by Columbia University, December 14-15 2020 (Virtual).
3. **X Zhang**, C Linder. *Computational modeling of energy storage materials*, 2018 Blume Center Affiliates/Alumni Meeting, Stanford, October 05, 2018.
2. **X Zhang**, C Linder. *Computational modeling of mechanics related phenomena in lithium-ion batteries*, 2018 eWear Annual Affiliate Member Meeting, Stanford, February 28, 2018.
1. **X Zhang**, C Linder. *Computational modeling of the formation and mechanical instability of SEI on silicon electrodes*, USNCCM 14, Montreal, Canada, July 17-20, 2017.

## PROFESSIONAL ACTIVITIES

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## Journal Reviewer

- since 2021 International Journal of Fracture
- since 2020 Computer Methods in Applied Mechanics and Engineering  
Engineering Fracture Mechanics
- since 2016 International Journal for Numerical and Analytical Methods in Geomechanics

## Conference Organizer

- 05/2019 Organizer, *Data-Driven Modeling* mini-symposium for PACAM XVI, Ann Arbor, Michigan, USA, May 19-23, 2019.

## Other Service

- 08/2021 Panelist for the 2021 Outstanding Postdoctoral Fellow Award in the University of Michigan, Ann Arbor.
- 04/2019 Judge for the Poster Presentation of the 2019 Michigan Institute for Computational Discovery and Engineering (MICDE) Symposium.