

Research Interest

Computational Mechanics (High Performance Computing; Topology Optimization)
Additive Manufacturing (Multi-scale Multi-physics Simulation; Metamaterial Design)
Machine Learning (Automatic Differentiation; Bayesian Methods)

Professional Experience

- 09/2023- **Assistant Professor**, *The Hong Kong University of Science and Technology*.
Now Civil and Environmental Engineering
- 2022-2023 **Postdoctoral Scholar**, *Northwestern University*.
Mechanical Engineering, Advisor: Prof. *Jian Cao*

Education

- 2017–2022 **Ph.D.**, *Princeton University*.
Civil and Environmental Engineering, Advisor: Prof. *Sigrid Adriaenssens*
Computer Science, Advisor: Prof. *Ryan P. Adams*
- 2013–2017 **B.Sc.**, *Shanghai Jiao Tong University*.
Mechanical Engineering (UM-SJTU Joint Institute), GPA - 3.80/4.0 (ranking 1/53)
- 2016 **Exchange Student**, *The University of Hong Kong*.
Mechanical Engineering

Peer-reviewed Publications

- [21] J.Choi, **T.Xue**, S.Liao, J.Cao, Accelerating phase-field simulation of three-dimensional microstructure evolution in laser powder bed fusion with composable machine learning predictions, *Additive Manufacturing*, 2024
- [20] X.Sun, G.Roeder, **T.Xue**, R.P.Adams, S.Rusinkiewicz, More Stiffness with Less Fiber: End-to-End Fiber Path Optimization for 3D-Printed Composites, *Proceedings of the 8th ACM Symposium on Computational Fabrication*, 2023
- [19] J.Shao, A.Samaei, **T.Xue**, X.Xie, S.Guo, J.Cao, E.MacDonald, Z.Gan, Additive friction stir deposition of metallic materials: process, structure and properties, *Materials & Design*, 2023
- [18] **T.Xue**, S.Liao, Z.Gan, C.Park, X.Xie, W.K.Liu, J.Cao, JAX-FEM: A differentiable GPU-accelerated 3D finite element solver for automatic inverse design and mechanistic data science, *Computer Physics Communications*, 2023.
- [17] C.Park, Y.Lu, S.Saha, **T.Xue**, J.Guo, S.Mojumder D. W.Apley, G.J.Wagner, W.K.Liu, Convolution Hierarchical Deep-learning Neural Network (C-HiDeNN) with Graphics Processing Unit (GPU) Acceleration, *Computational Mechanics*, 2023.
- [16] S.Liao, J.Jeong, R.Zha, **T.Xue**, J.Cao, Simulation-guided feedforward-feedback control of melt pool temperature in directed energy deposition, *CIRP Annals*, 2023.
- [15] S.Liao, **T.Xue**, J.Jeong, S.Webster, K.Ehmann, J.Cao, Hybrid full-field thermal characterization of additive manufacturing processes using physics-informed neural networks with data, *Computational Mechanics*, 2023.

- [14] M.Mozaffar, S.Liao, J.Jeong, **T.Xue**, J.Cao, Differentiable simulation for material thermal response design in additive manufacturing processes, *Additive Manufacturing*, 2023.
- [13] **T.Xue**, S.Adriaenssens, S.Mao, Learning the nonlinear dynamics of soft mechanical metamaterials with graph networks, *International Journal of Mechanical Sciences*, 2023.
- [12] **T.Xue**, Z.Gan, S.Liao, J.Cao, Physics-embedded graph network for accelerating phase-field simulation of microstructure evolution in additive manufacturing, *npj Computational Materials*, 2022.
- [11] **T.Xue**, S.Mao, Mapped shape optimization method for rational design of cellular mechanical metamaterials under large deformation, *International Journal for Numerical Methods in Engineering*, 2022.
- [10] X.Sun, **T.Xue**, S.M. Rusinkiewicz, R.P.Adams, Amortized Synthesis of Constrained Configurations Using a Differentiable Surrogate, *NeurIPS*, 2021.
- [9] **T.Xue**, S.Adriaenssens, S.Mao, Mapped phase field method for brittle fracture, *Computer Methods in Applied Mechanics and Engineering*, 2021.
- [8] **T.Xue**, W.C.Sun, S.Adriaenssens, Y.Wei, C.Liu, A new finite element level set reinitialization method based on the shifted boundary method, *Journal of Computational Physics*, 2021.
- [7] A.Beatson, J.T.Ash, G.Roeder, **T.Xue**, R.P.Adams, Learning Composable Energy Surrogates for PDE Order Reduction, *NeurIPS*, 2020.
- [6] **T.Xue**, T.J.Wallin, Y.Menguc, S.Adriaenssens, M.Chiaromonte Machine learning generative models for automatic design of multi-material 3D printed composite solids, *Extreme Mechanics Letters*, 2020.
- [5] **T.Xue**, A.Beatson, S.Adriaenssens, R.P.Adams, Amortized Finite Element Analysis for Fast PDE-Constrained Optimization, *ICML*, 2020.
- [4] **T.Xue**, A.Beatson, M.Chiaromonte, G.Roeder, J.T.Ash, Y.Menguc, S.Adriaenssens, R.P.Adams, S.Mao, A data-driven computational scheme for the nonlinear mechanical properties of cellular mechanical metamaterials under large deformation, *Soft Matter*, 2020.
- [3] Y.Wan, **T.Xue**, Y.Shen, The successive node snapping scheme for an evolving branched curve in 2D and 3D, *Computer-Aided Design*, 2019.
- [2] Y.Wan, **T.Xue**, Y.Shen, The successive node snapping scheme: A method to obtain conforming meshes for an evolving curve in 2D and 3D, *Finite Elements in Analysis and Design*, 2019.
- [1] M.Ma, **T.Xue**, S.Chen, Y.Guo, Y.Chen, H.Liu, Features of structural relaxation in diblock copolymers, *Polymer Testing*, 2017.

Teaching

- 2024- **Course Instructor**, The Hong Kong University of Science and Technology.
CIVL 4370 Computer Methods of Structural Analysis
- 2017-2021 **Graduate Teaching Assistant**, Princeton University.
SML201 Introduction to Data Science
COS424 Fundamentals of Machine Learning
CEE205 Mechanics of Solids
- 2013-2017 **Undergraduate Teaching Assistant**, Shanghai Jiao Tong University.
VM382 Mechanical Behaviour of Materials
VP140 Physics

Internship

- 2020 **Quantitative Researcher**, Sixie Capital, Shanghai.
Statistical analysis of market data: Seeking investment alpha

- 2019 **Research Intern**, Facebook Inc., Redmond.
AR/VR at Facebook Reality Labs: Deep learning for 3D printing material design
- 2017 **Product Design Engineer**, Apple Inc., Shanghai.
Apple accessories team: Keyboard design and manufacturing

Presentations

- 2023 *Invited Talk*: College of Aerospace Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing
- 2023 *Invited Talk*: AI for Science Summit, Beijing
- 2023 *Presenting Author*: 17th U.S. National Congress on Computational Mechanics, Albuquerque
- 2022 *Presenting Author*: Annual International Solid Freeform Fabrication Symposium, Austin
- 2021 *Invited Talk*: College of Pipeline and Civil Engineering, China University of Petroleum, Zoom
- 2021 *Student Award*: USACM Workshop on New Trends and Open Challenges in Computational Mechanics: from Nano to Macroscale, Zoom
- 2020 *Contributed Talk*: ICLR Workshop on Integration of Deep Neural Models and Differential Equations, Zoom
- 2018 *Presenting Author*: 13th World Congress on Computational Mechanics, New York

Reviewing

PNAS; Nature Materials; npj Computational Materials; Extreme Mechanics Letters; Journal of Computing and Information Science in Engineering; Journal of Manufacturing Science and Engineering; International Journal of Plasticity; Physics of Fluids

Selected Honors

- | | | |
|------|-----------------------------------|--|
| 2017 | Gordon Y.S. Wu Fellowships | <i>A highly prestigious award at Princeton University</i> |
| 2016 | The Merit Student Model | <i>Person of the year at Shanghai Jiao Tong University</i> |
| 2015 | National Scholarship | <i>Top scholarship for undergraduate students in China</i> |

Software

JAX-AM An open-source Python library for numerical simulations in additive manufacturing with GPU acceleration and automatic sensitivity analysis.

JAX-FEM A GPU-accelerated differentiable finite element package based on JAX.

Skills

Tools Matlab, L^AT_EX

Programming Languages Python, C/C++

Languages

Mandarin

Native

English

TOEFL: 111/120

References

Jian Cao, Cardiss Collins Professor (Member of NAE, Member of AAAS).
Department of Mechanical Engineering,
Northwestern University.
E-mail: jcao@northwestern.edu

Sigrid Adriaenssens, Professor.
Department of Civil and Environmental Engineering,
Princeton University.
E-mail: sadriaen@princeton.edu

Ryan P. Adams, Professor.
Department of Computer Science,
Princeton University.
E-mail: rpa@princeton.edu