

Tianju Xue (薛添驹)

Ph.D., Princeton University

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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**, 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

- [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 meta-materials 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.Chiamonte 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.Chiamonte, 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

- 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, Qingdao
- 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

ASME Journal of Computing and Information Science in Engineering

International Journal of Plasticity

Selected Honors

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|------|-----------------------------------|------------------------------------------------------------|
| 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.

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