

## Research Interest

Computational Mechanics (Topology Optimization; High Performance Computing)

Additive Manufacturing (Metamaterial Design; Multi-scale Multi-physics Simulation)

Machine Learning (Automatic Differentiation; Bayesian Methods)

## Professional Experience

01/2022- **Postdoctoral Scholar**, Northwestern University.

Now Mechanical Engineering, Advisor: Prof. *Jian Cao*

## Education

2017–2022 **Ph.D.**, Princeton University.

Civil 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

- 2022 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*, 2022.
- 2022 M.Mozaffar, S.Liao, J.Jeong, **T.Xue**, J.Cao, Differentiable simulation for material thermal response design in additive manufacturing processes, *Additive Manufacturing*, 2022.
- 2022 **T.Xue**, S.Mao, Learning the nonlinear dynamics of soft mechanical metamaterials with graph networks, *International Journal of Mechanical Sciences*, 2022.
- 2022 **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.
- 2022 **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.
- 2021 X.Sun, **T.Xue**, S.M. Rusinkiewicz, R.P.Adams, Amortized Synthesis of Constrained Configurations Using a Differentiable Surrogate, *NeurIPS*, 2021.
- 2021 **T.Xue**, S.Adriaenssens, S.Mao, Mapped phase field method for brittle fracture, *Computer Methods in Applied Mechanics and Engineering*, 2021.
- 2021 **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.
- 2020 A.Beatson, J.T.Ash, G.Roeder, **T.Xue**, R.P.Adams, Learning Composable Energy Surrogates for PDE Order Reduction, *NeurIPS*, 2020.

- 2020 **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.
- 2020 **T.Xue**, A.Beatson, S.Adriaenssens, R.P.Adams, Amortized Finite Element Analysis for Fast PDE-Constrained Optimization, *ICML*, 2020.
- 2020 **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.
- 2019 Y.Wan, **T.Xue**, Y.Shen, The successive node snapping scheme for an evolving branched curve in 2D and 3D, *Computer-Aided Design*, 2019.
- 2019 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.
- 2017 M.Ma, **T.Xue**, S.Chen, Y.Guo, Y.Chen, H.Liu, Features of structural relaxation in diblock copolymers, *Polymer Testing*, 2017.

## Ongoing Works

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, *Progress in Materials Science* (Under Review).

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* (Under Review).

**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* (Under Review).

S.Liao, J.Jeong, R.Zha, **T.Xue**, J.Cao, Simulation-guided feedforward-feedback control of melt pool temperature in directed energy deposition, *CIRP* (Under Review).

## 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

- 2022 Annual International Solid Freeform Fabrication Symposium

- 2021 USACM Workshop on New Trends and Open Challenges in Computational Mechanics: from Nano to Macroscale
- 2020 ICLR Workshop on Integration of Deep Neural Models and Differential Equations
- 2018 13th World Congress on Computational Mechanics

## Reviewing

*Nature Materials*

*npj Computational Materials*

*Extreme Mechanics Letters*

*NeurIPS*

*ASME Journal of Computing and Information Science in Engineering*

## Selected Honors

- |      |                                   |  |
|------|-----------------------------------|--|
| 2017 | <b>Gordon Y.S. Wu Fellowships</b> | <i>A highly prestigious award at Princeton University</i>  |
| 2016 | <b>The Merit Student Model</b>    | <i>Person of the year at Shanghai Jiao Tong University</i> |
| 2015 | <b>National Scholarship</b>       | <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<sup>A</sup>T<sub>E</sub>X

**Programming Languages** Python, C/C++

## Languages

**Mandarin**

*Native*

**English**

*TOEFL: 111/120*

## References

Jian Cao, Cardiss Collins Professor, NAE Member.  
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 Northwestern University.  
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Sigrid Adriaenssens, Professor.  
 Department of Civil and Environmental Engineering,  
 Princeton University.  
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Ryan P. Adams, Professor.  
 Department of Computer Science,  
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Zhengtao Gan, Assistant Professor.  
 Department of Aerospace & Mechanical Engineering,  
 The University of Texas at El Paso.  
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