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

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

[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*, 2022.

[14] M.Mozaffar, S.Liao, J.Jeong, **T.Xue**, J.Cao, Differentiable simulation for material thermal response design in additive manufacturing processes, *Additive Manufacturing*, 2022.

[13] **T.Xue**, S.Adriaenssens, S.Mao, Learning the nonlinear dynamics of soft mechanical metamaterials with graph networks, *International Journal of Mechanical Sciences*, 2022.

[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.Chiaramonte 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.Chiaramonte, 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.

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).

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).

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

PNAS

Nature Materials

npj Computational Materials

Extreme Mechanics Letters

ASME Journal of Computing and Information Science in Engineering

Selected Honors

2017 **Gordon Y.S. Wu Fellowships** *A highly prestigious award at Princeton University*

2016 **The Merit Student Model** *Person of the year at Shanghai Jiao Tong University*

2015 **National Scholarship** *Top scholarship for undergraduate students in China*

Software

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

Skills

Tools Matlab, LaTeX

Programming Languages Python, C/C++

Languages

Mandarin *Native*

English *TOEFL: 111/120*

References

Jian Cao, Cardiss Collins Professor, NAE Member.
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

Zhengtao Gan, Assistant Professor.
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The University of Texas at El Paso.
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