Dehao Liu

Assistant Professor
Department of Mechanical Engineering
The State University of New York at Binghamton, Binghamton, NY, USA
Email: dehaoliu@binghamton.edu | Website: https://immdlab.github.io/

Education

Ph.D. in Mechanical Engineering, Georgia Institute of Technology, Atlanta 08/2021

M.S. in Mechanical Engineering, Georgia Institute of Technology, Atlanta 12/2020

B.S. in Mechanical Engineering, Tsinghua University, Beijing, China 07/2016

Employment History

Assistant Professor, The State University of New York at Binghamton 01/2022-Present
Department of Mechanical Engineering

Postdoctoral Researcher, Texas A&M University 09/2021-12/2021
Computational Materials Science Lab, Scientific Machine Learning Lab
Advisor: Prof. Raymundo Arroyave, Prof. Ulisses Braga-Neto

Graduate Research Assistant, Georgia Institute of Technology 08/2016-08/2021
Multi-Scale System Engineering Research Group
Advisor: Prof. Yan Wang

Graduate Intern, Siemens Corporate Technology 05/2019-08/2019
Product Simulation and Modeling Group
Mentor: Dr. Elena Arvanitis, Dr. Lucia Mirabella

Graduate Intern, Idaho National Laboratory (INL) 06/2018-08/2018
Fuels Modeling and Simulation Department
Mentor: Dr. Larry Aagesen

Honors and Awards

- Journal of Computing and Information Science in Engineering (JCISE) Reviewers of the Year Award, 2021

Publications and Creative Products (Student*, Corresponding Author)

Please see my Google Scholar for a full and updated list of publications.

A. Refereed Book Chapters

1. **Liu, D.**, Lu, Y., and Wang, Y. (2024) Physics Informed Machine Learning for Metal Additive Manufacturing. *Machine Learning for Powder-Based Metal Additive Manufacturing*, eds. by G. Singh, F. Imani, A. Tewari, and S. Mishra (Elsevier), pp. 77.

2. Sestito, J.M., **Liu, D.**, Lu, Y., Song, J.-H., Tran, A.V., Kempner, M.J., Harris, T.A.L., Ahn, S.-H., and Wang, Y. (2020) Multiscale process modeling of shape memory alloy fabrication with directed energy deposition. *Manufacturing in the Era of 4th Industrial Revolution: A World Scientific Reference Volume 1: Recent Advances in Additive Manufacturing*, eds. by H. Bruck, Y. Chen, and S.K. Gupta (World Scientific), pp. 41-76.
3. Tran, A.V., **Liu, D.**, He, L., and Wang, Y. (2020) Data-driven acceleration of first-principles saddle point and local minimum search based on scalable Gaussian processes. *Uncertainty Quantification in Multiscale Materials Modeling*, eds. by Y. Wang and D.L. McDowell (Elsevier), Ch.5, pp.119-168.

B. Refereed Journal Articles

1. Li, G.*, Lu, Y., and **Liu, D.** Solving spatial-temporal PDEs with arbitrary boundary conditions using physics-constrained convolutional recurrent neural networks. *Neurocomputing*. (under review)
2. Pan, L., Li, G.*, Zhang, X., Cheng, J., **Liu, D.**, and Lu, Y. Multi-task physics-constrained dictionary learning for efficient estimation of porosity distribution in laser powder bed fusion of copper. *Journal of Manufacturing Processes*. (under review)
3. Xu, L., Wang, Z., Rodgers, T., **Liu, D.**, Tran, A.V., and Xu, H. Exascale granular microstructure reconstruction in 3D volumes of arbitrary geometries with generative learning. *Acta Materialia*. (under review)
4. Hoffman, N., Diniz, C., **Liu, D.**, Rodgers, T., Fuge, M., and Tran, A.V. GrainPaint: A multi-scale diffusion-based generative model for microstructure reconstruction of large-scale objects. *Acta Materialia*. (accepted)
5. Zhu, T., **Liu, D.**, and Lu, Y. Finite-volume physics-informed U-Net for flow field reconstruction with sparse data. *Journal of Computing and Information Science in Engineering*. (under review)
6. Chavoshnejad, P., Li, G.*, Solhtalab, A., **Liu, D.**, and Razavi, M. J. A theoretical framework for predicting the heterogeneous stiffness map of brain white matter tissue. *Physical Biology*, **21**(6), 066004.
7. Foroughi, A. H., **Liu, D.**, and Razavi, M. J. (2023). Simultaneous optimization of stiffness, permeability, and surface area in metallic bone scaffolds. *International Journal of Engineering Science*, **193**, 103961.
8. **Liu, D.** and Wang, Y. (2023). Physics-constrained neural networks with minimax architecture for multiphysics dendritic growth problems in additive manufacturing. *Manufacturing Letters*, **35**, 1060-1071.
9. **Liu, D.**, Pusarla, P., and Wang, Y. (2023). Multifidelity physics-constrained neural networks with minimax architecture. *Journal of Computing and Information Science in Engineering*, **23**(3), 031008.
10. Malashkhia, L., **Liu, D.**, Lu, Y., and Wang, Y. (2023). Physics-constrained Bayesian neural network for bias and variance reduction. *Journal of Computing and Information Science in Engineering*, **23**(1), 011012.
11. **Liu, D.** and Wang, Y. (2022). Metal additive manufacturing process design based on physics constrained neural networks and multi-objective Bayesian optimization. *Manufacturing Letter*, **33**, 817-827.
12. Tran, A., Sun, J., **Liu, D.**, Wildey, T., and Wang, Y. (2022). Stochastic reduced-order model with temporal upscaling for uncertainty propagation in materials modeling. *Journal of Computing and Information Science in Engineering*, **22**(6), 061005.
13. Biswas, S., **Liu, D.**, & Jiang, W. (2022). Solidification and grain formation in alloys: a 2D application of the grand-potential-based phase-field approach. *Modelling and Simulation in Materials Science and Engineering*, **30**(2), 025013.
14. **Liu, D.** and Wang, Y. (2021) A Dual-Dimer method for training physics-constrained neural networks with minimax architecture. *Neural Networks*, **136**: 112-125.

15. **Liu, D.** and Wang, Y. (2020) Multiphysics simulation of nucleation and grain growth in selective laser melting of alloys. *Journal of Computing and Information Science in Engineering*, **20**(5).
16. **Liu, D.** and Wang, Y. (2019) Multi-fidelity physics-constrained neural network and its application in materials modeling. *Journal of Mechanical Design*, **141**(12): 121403.
17. Cao, L., **Liu, D.**, Jiang, P., Shao, X., Zhou, Q., and Wang, Y. (2019) Multi-physics simulation of dendritic growth in magnetic field assisted solidification. *International Journal of Heat and Mass Transfer*, **144**: 118673.
18. Tran, A.V., **Liu, D.**, Tran, H., and Wang, Y. (2019) Quantifying uncertainty in the process-structure relationship for Al-Cu solidification. *Modelling and Simulation in Materials Science and Engineering*, **27**(6): 064005.
19. **Liu, D.** and Wang, Y. (2019) Mesoscale multi-physics simulation of rapid solidification of Ti-6Al-4V alloy. *Additive Manufacturing*, **25**: 551-562.
20. Nie, Z., Wang, G., **Liu, D.**, and Rong, Y. K. (2018). A statistical model of equivalent grinding heat source based on random distributed grains. *Journal of Manufacturing Science and Engineering*, **140**(5): 051016.
21. **Liu, D.**, Wang, G., Yu, J., and Rong, Y. K. (2017). Molecular dynamics simulation on formation mechanism of grain boundary steps in micro-cutting of polycrystalline copper. *Computational Materials Science*, **126**: 418-425.
22. Nie, Z., Wang, G., Yu, J., **Liu, D.**, and Rong, Y. K. (2016). Phase-based constitutive modeling and experimental study for dynamic mechanical behavior of martensitic stainless steel under high strain rate in a thermal cycle. *Mechanics of Materials*, **101**: 160-169.
23. **Liu, D.**, Wang, G., Nie, Z., and Rong, Y. K. (2016). An in-situ infrared temperature-measurement method with back focusing on surface for creep-feed grinding. *Measurement*, **94**: 645-652.

C. Refereed Conference Proceedings

1. Yang, J., and **Liu, D.** "Effects of processing parameters on joining strength of 316L-Cu interface in multi-materials laser powder bed fusion." *Proceedings of the 51th SME North American Manufacturing Research Conference (NAMRC 53)*. June 23-27, 2025, Clemson, South Carolina. (under review)
2. Elhadad, A., Li, G., Yang, J., **Liu, D.**, and Choi, S. "3D-printed stainless steel electrodes for advancing MEMS microbial fuel cells toward sustainable on-chip energy." *IEEE 38th International Conference on Micro Electro Mechanical Systems (MEMS)*. January 19-23, 2025, Kaohsiung, Taiwan.
3. Li, G.*, Lu, Y., and **Liu, D.** "Physics-constrained convolutional recurrent neural networks for solving spatial-temporal PDEs with arbitrary boundary conditions." *Proceedings of the ASME 2024 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE2024)*, August 25-28, 2024, Washington, DC, paper No. IDETC2024-134569.
4. Zhu, T., **Liu, D.**, and Lu, Y. "Finite-volume physics-informed U-Net for flow field reconstruction with sparse data." *Proceedings of the ASME 2024 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE2024)*, August 25-28, 2024, Washington, DC, paper No. IDETC2024-142088.
5. **Liu, D.** and Wang, Y. "Physics-constrained neural networks with minimax architecture for multiphysics dendritic growth problems in additive manufacturing." *Proceedings of the 51th SME North American Manufacturing Research Conference (NAMRC 51)*. June 12-16, 2023, New Brunswick, New Jersey.
6. **Liu, D.**, Pusaria, P., and Wang, Y. "Multi-fidelity physics-constrained neural networks with minimax architecture for materials modeling." *Proceedings of the ASME 2022 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE2022)*, August 14-17, 2022, St. Louis, Missouri, paper No. IDETC2022-91219.

7. **Liu, D.** and Wang, Y. "Metal additive manufacturing process design based on physics constrained neural networks and multi-objective Bayesian optimization." *Proceedings of the 50th SME North American Manufacturing Research Conference (NAMRC 50)*. June 27-July 1, 2022, West Lafayette, Indiana.
8. **Liu, D.** and Wang, Y. "Simulation of nucleation and grain growth in selective laser melting of Ti-6Al-4V alloy." *Proceedings of 2019 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE2019), August 18-21, 2019, Anaheim, California*, Paper No. DETC2019-97684.
9. **Liu, D.** and Wang, Y. "Multi-fidelity physics-constrained neural network and its application in materials modeling." *Proceedings of 2019 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE2019), August 18-21, 2019, Anaheim, California*, Paper No. DETC2019-98115.
10. **Liu, D.** and Wang, Y. "Mesoscale multi-physics simulation of solidification in selective laser melting process using a phase field and thermal lattice Boltzmann model." *Proceedings of 2017 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE2017), Aug. 6-9, 2017, Cleveland, Ohio*, Paper No. DETC2017-67633.
11. **Liu, D.**, Wang, G., Nie, Z., and Rong, Y. K. "Numerical simulation of the austenitizing process in hypoeutectoid Fe-C steels." *Proceedings of the ASME 2014 International Manufacturing Science and Engineering Conference (MSEC2014), June 9-13, 2014, Detroit, Michigan*, Paper No. MSEC2014-3948.

D. Under Preparation Journal Articles

1. Li, G.*, and **Liu, D.** Inverse design of architected composite materials with desired mechanical behavior based on conditional diffusion model.
2. Yang, J.*, and **Liu, D.** Effects of Processing Parameters on Joining Strength of 316L-Cu Interface in Multi-Materials Laser Powder Bed Fusion.
3. Malashkhia L., **Liu, D.**, Tran, A.V., Wang, Y. Physics-constrained Bayesian neural network to predict grain evolution.
4. Olson M., Li G., Huang P., and **Liu D.** Real-time melt pool monitoring and diagnostics in laser powder bed fusion based on single-camera two-wavelength imaging pyrometry and machine learning.

E. Software

1. **Liu, D.** and Wang, Y., Phase-Filed and Thermal Lattice Boltzmann Method.
2. **Liu, D.** and Wang, Y., Dual-Dimer method.

F. Patents

1. Mirabella, L., Arvanitis, E., **Liu, D.**, Lammens, N., Erdelyi, H., and Ludwig, C., "System and method for fatigue response prediction," U.S. Patent No. US20230062268A1, March 2, 2023.
2. Wang, G., Nie, Z., **Liu, D.**, and Rong, Y. K., "A temperature measurement device for grinding experiments," C.N. Patent No. CN104596646B. December 19, 2017.
3. Wang, G., Nie, Z., Rong, Y. K., **Liu, D.**, and Wei, S., "System and method for temperature monitoring and analysis based on LabVIEW and thermocouples," C.N. Patent No. CN103674328B. June 29, 2016.

G. Presentations

G1. Conference Presentations

1. Li, G., Chavoshnejad, P., Razavi, M. J., and **Liu, D.** "Physics-informed convolutional neural networks for modeling structure-property relationships of fiber-reinforced composite materials," TMS 2024 Annual Meeting & Exhibition, March 3-7, 2024, Orlando, Florida
2. Malashkhia, L., **Liu, D.**, Tran, A.V., and Wang, Y. "Physics-constrained Bayesian neural networks to predict grain evolution," TMS 2024 Annual Meeting & Exhibition, March 3-7, 2024, Orlando, Florida
3. **Liu, D.** and Wang, Y. "Multiphysics-constrained neural networks for predicting dendritic growth in additive manufacturing," Proceedings of the ASME 2023 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE2023), August 20-23, 2023, Boston, Massachusetts
4. **Liu, D.** and Wang, Y. **(Invited)** "Mesoscale simulation of nucleation and grain growth of Ti-6Al-4V alloy in selective laser melting," The 2nd International Conference on Simulation for Additive Manufacturing, Sept. 11-13, 2019, Pavia, Italy.
5. Wang, Y. and **Liu, D. (Plenary Lecture)** "Multi-fidelity physics-constrained neural networks for materials design," 2018 Design Science Research Workshop on Data Driven Design and Learning, August 23-25, 2018 Montreal, Canada
6. **Liu, D.** and Wang, Y. "Mesoscale multi-physics simulation of solidification in selective laser melting process," The 4th TMS World Congress on Integrated Computational Materials Engineering (ICME 2017), May 21-25, 2017, Ypsilanti, Michigan.

G2. Invited Seminar Presentations

1. **Liu, D.** "Simulation of nucleation and grain growth in selective laser melting of Ti-6Al-4V alloy," Dec. 19, 2019, Southern University of Science and Technology, Shenzhen, China.
2. **Liu, D.** "Mesoscale multi-physics simulation of rapid solidification of Ti-6Al-4V alloy," Jan. 28, 2019, Lawrence Livermore National Laboratory, Livermore, California.

Grants and Contracts

Grants

1. Collaborative Research: Physics-Informed Machine Learning for Tailoring the Multidirectional Mechanical Properties of Composite Materials, NSF Computational and Data-Enabled Science and Engineering (NSF 2347658), 2024-2027, Co-PI, **$156,543** (total: $313,087, PI: Mir Jalil Razavi)
2. Machine Learning Accelerated Process Development for Scalable Manufacturing of Silica-based Glass Encapsulated Phase Change Materials Using Flow Mold Casting, DOE Office of Energy Efficiency and Renewable Energy (DE-EE0009095), 2024-2026, Co-PI (total: $150,276, PI: Jingzhou Zhao)
3. Accurate Characterization of the Heterogeneous Stiffness Map of the Human Brain White Matter, Transdisciplinary Areas of Excellence Seed Grant Program at Binghamton University, 2022-2023, Co-PI, **$5,000** (total: $10,000, PI: Mir Jalil Razavi, funded)

Teaching

The State University of New York at Binghamton

ME 303	Engineering Computational Method (154 students)	Spring 2025
ME 531	Applied Machine Learning for ME (27 students)	Spring 2025
ME 303	Engineering Computational Method (137 students)	Spring 2024
ME 531X	Applied Machine Learning for ME (21 students)	Fall 2023
ME 303	Engineering Computational Method (121 students)	Spring 2023
ME 571	Manufacturing Processes I (28 students)	Fall 2022
ME 417	Introduction to Finite Element Method (13 students)	Spring 2022

Georgia Institute of Technology
ME 6104 (Guest Lecturer) Computer-Aided Design Spring 2020

Mentorship for PhD Students

- **Ph.D. Students Advisory**

1. Guangfa Li (Spring 2023-Present), passed the comprehensive exam in Summer 2024
   Research Project: *Physics-constrained neural networks for multiphysics problems*
2. Jiaqi Yang (Fall 2023-Present)
   Research Project: *Multiscale multiphysics modeling of multi-materials metal additive manufacturing*

- **Ph.D. Committee**

1. Yangyang Lai, graduated in Summer 2024
2. Hasib Ahmed Prince, passed the comprehensive exam in Summer 2024
3. Yikang Jing, graduated in Spring 2024
4. Yue Zhou, graduated in Summer 2023
5. Zihan Liu, passed the comprehensive exam in Summer 2022
6. Sari Al Zerey, passed the prospectus in Fall 2022

Mentorship for Undergraduate Students

- **Georgia Institute of Technology**

1. Yufeng Wang (Spring 2017)
   Research Project: *Big data analytics for cyber manufacturing*
2. Alizay Shah (Summer 2017)
   Research Project: *Process monitoring and data analytics for cyber manufacturing*
3. Pranav Pusarla (Spring 2020-Spring 2021)
   Research Project: *Multi-fidelity physics-constrained neural networks with minimax architecture for materials modeling*
4. Yash Patel (Fall 2020-Spring 2021)
   Research Project: *Physics-constrained neural networks for battery life prediction*
5. Rohan Sundeep Punamiya (Summer 2021)
   Research Project: *Physics-constrained neural networks for battery life prediction*

- **The State University of New York at Binghamton**

1. Matthew W Olson (Summer 2022-Summer 2024)
   Research Project: *In-situ process monitoring for metal additive manufacturing*
   Outcome: One journal paper in preparation
2. Anirudh Ramkumar Sivasankaran (Fall 2023-Present)
   Research Project: *Design of optical enclosures; Design of interlocking metasurface for multi-materials additive manufacturing*

Service

A. Editorial Board Memberships
Guest Editor, ASME Journal of Computing and Information Science in Engineering, special issue on "Scientific Machine Learning for Manufacturing Processes and Material Systems", 2023-2024

B. Society Offices and Activities

1. ASME Computers and Information in Engineering Division, Advanced Modeling and Simulation Technical Committee, Vice Chair, 2024–2025
2. ASME Computers and Information in Engineering Division, Advanced Modeling and Simulation Technical Committee, Secretary, 2023–2024
3. ASME Computers and Information in Engineering Division, Advanced Modeling and Simulation Technical Committee, Members at Large, 2022–2023

C. Symposium/Event Organized

Organizer	TMS Annual Meeting & Exhibition, Symposium of AI/Data Informatics: Computational Model Development, Verification, Validation, and Uncertainty Quantification, 2024-Present
Organizer	ASME Computers and Information in Engineering (CIE) Conference, Symposium of Physics-Informed Machine Learning for Design and Advanced Manufacturing, 2023-Present
Committee Member	ASME Computers and Information in Engineering (CIE) Student Hackathon, 2020-2023 https://asmehackathon.github.io/

D. Journal Reviews

1. Additive Manufacturing
2. Applied Thermal Engineering
3. Applied Physics A
4. Computational Materials Science
5. Composite Part B: Engineering
6. Engineering Research Express
7. Expert Systems with Applications
8. International Journal of Production Research
9. Journal of Computing and Information Science in Engineering
10. Journal of Manufacturing Processes
11. Journal of Thermal Science
12. Materials Research Express
13. Modelling and Simulation in Materials Science and Engineering

E. Conference Proceedings Reviews

- ASME International Design Engineering Technical Conference & Computers and Information in Engineering Conference (IDETC/CIE), 2017-present
- North American Manufacturing Research Conference (NAMRC), 2022-present

F. Proposals Panels and Reviews

- Department of Energy (DOE) Advanced Materials & Manufacturing Technologies Office (AMMTO), Smart Manufacturing Technologies for Material and Process Innovation, 2024
- Swiss National Science Foundation-European Cooperation in Science and Technology (COST) Proposal, 2024
- National Science Foundation (NSF) CMMI, 2022
- Georgia Tech President's Undergraduate Research Awards, June 19, 2020

G. Department Committee Service

Graduate Studies Committee, Fall 2022-Present
Academic Advisor for Senior Projects, Fall 2022-Present
Academic Advisor for Undergraduate Students, Spring 2022-Present

H. Academic Program Development

Guest Lecturer — International Summer Exchange Program, Georgia Tech Manufacturing Institute, Summer 2017

I. Professional Memberships

The American Society of Mechanical Engineers (ASME), 2015-Present
The Minerals, Metals & Materials Society (TMS), 2017-Present
The Society of Manufacturing Engineers (SME), 2023-Present