Dehao Liu

Assistant Professor
Department of Mechanical Engineering
State University of New York at Binghamton, Binghamton, NY 13902, USA
Email: dehaoliu@binghamton.edu | Website: https://icmdlab.github.io/

Education

Georgia Institute of Technology Atlanta, GA
Ph.D., Mechanical Engineering Aug. 2021

Dissertation: *Investigation of process-structure relationship for additive manufacturing with multiphysics simulation and physics-constrained machine learning*
Committee: Prof. Yan Wang (Chair), Prof. David L. McDowell (ME), Prof. Shreyes N. Melkote (ME), Prof. Tuo Zhao (ISYE), Prof. Sudarsanam Suresh Babu (ORNL/UT)

Georgia Institute of Technology Atlanta, GA
M.S., Mechanical Engineering Dec. 2020

Tsinghua University Beijing, China
B.S., Mechanical Engineering Jul. 2016

Employment History

Assistant Professor, State University of New York at Binghamton Binghamton, NY
Department of Mechanical Engineering Jan. 2022-Present

Postdoctoral Researcher, Texas A&M University College Station, TX
Computational Materials Science Lab, Scientific Machine Learning Lab Sep. 2021-Dec. 2021
Advisor: Prof. Raymundo Arroyave, Prof. Ulisses Braga-Neto

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

Graduate Intern, Siemens Corporate Technology Princeton, NJ
Product Simulation and Modeling Group May 2019-Aug. 2019
Mentor: Dr. Elena Arvanitis, Dr. Lucia Mirabella

Graduate Intern, Idaho National Laboratory (INL) Idaho Falls, ID
Fuels Modeling and Simulation Department Jun. 2018-Aug. 2018
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

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

A. Refereed Book Chapters

1. 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.
2. 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. **Liu D.** and Wang Y. (2022). Metal additive manufacturing process design based on physics constrained neural networks and multi-objective Bayesian optimization. *Manufacturing Letter* (accepted)
2. 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* (accepted).
3. 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.
4. **Liu D.** and Wang Y. (2021) A Dual-Dimer method for training physics-constrained neural networks with minimax architecture. *Neural Networks*, **136**: 112-125.
5. **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).
6. **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.
7. 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.
8. 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.
9. **Liu D.** and Wang Y. (2019) Mesoscale multi-physics simulation of rapid solidification of Ti-6Al-4V alloy. *Additive Manufacturing*, **25**: 551-562.

10. 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.
11. **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.
12. 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.
13. **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. **Liu D.** and Wang Y. Metal additive manufacturing process design based on physics constrained neural networks and multi-objective Bayesian optimization. *50th SME North American Manufacturing Research Conference (accepted).*
2. **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.
3. **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.
4. **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.
5. **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. Submitted Manuscripts

1. **Liu D.** and Wang Y. Multi-fidelity physics-constrained neural networks with minimax architecture for materials modeling. *Proceedings of 2022 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE2022), August 14-17, 2022, St. Louis, Missouri*, Paper No. DETC2022-91219.
2. **Liu D.** and Wang Y. (2022). Physics-constrained neural networks with minimax architecture for multiphysics dendritic growth problems. *Computer Methods in Applied Mechanics and Engineering*.

E. Under Preparation Journal Articles

1. **Liu D.** and Wang Y. Predicting state of health for batteries based on physics-constrained neural networks.

F. Software

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

G. Patents

1. Mirabella L., Arvanitis E., **Liu D.**, Lammens N., Erdelyi H., and Ludwig C., "System and method for fatigue response prediction," Filing Number: PCT/US2020/019691. February 25, 2020.
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.

H. Presentations

H1. Conference Presentations

1. **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.
2. 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
3. **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.

H2. 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

Pending Proposals

- Digital Twin of Metal Additive Manufacturing for Process Monitoring and Control, NIST Metals-based Additive Manufacturing Grant Program (MBAMGP), 2022-2024, PI, $712,754
- 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, (PI: Mir Jalil Razavi), $11040

Teaching

Binghamton University
ME 417 Introduction to Finite Element Method, Number of Students: 13 Spring 2022

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

Mentorship for Undergraduate Students

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

Service

A. Symposium/Event Organized

Committee Member ASME Computers and Information in Engineering (CIE) Student Hackathon, 2020-2022
https://asmehackathon.github.io/

B. Journal Reviews

1. Additive Manufacturing
2. Applied Thermal Engineering
3. Computational Materials Science
4. Engineering Research Express
5. Expert Systems with Applications
6. International Journal of Production Research
7. Journal of Computing and Information Science in Engineering
8. Journal of Thermal Science
9. Materials Research Express
10. Modelling and Simulation in Materials Science and Engineering

C. Conference Proceedings Reviews

- ASME International Design Engineering Technical Conference & Computers and Information in Engineering Conference (IDETC/CIE), 2017-2021
- North American Manufacturing Research Conference (NAMRC), 2022

D. Proposals Panels and Reviews

- National Science Foundation CMMI, 2022
- Georgia Tech President's Undergraduate Research Awards, June 19, 2020

E. Academic Program Development

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

F. Professional Memberships

The American Society of Mechanical Engineers (ASME), 2015-2021
The Minerals, Metals & Materials Society (TMS), 2017