

# Dehao Liu

Assistant Professor

Department of Mechanical Engineering

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## Education

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<b>Georgia Institute of Technology</b>	Atlanta, GA
<b>Ph.D., Mechanical Engineering</b>	Aug. 2021
Dissertation: <i>Investigation of process-structure relationship for additive manufacturing with multiphysics simulation and physics-constrained machine learning</i>	
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)	
<b>Georgia Institute of Technology</b>	Atlanta, GA
<b>M.S., Mechanical Engineering</b>	Dec. 2020
<b>Tsinghua University</b>	Beijing, China
<b>B.S., Mechanical Engineering</b>	Jul. 2016

## Employment History

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<b>Assistant Professor, State University of New York at Binghamton</b>	Binghamton, NY
Department of Mechanical Engineering	Jan. 2022-Present
<b>Postdoctoral Researcher, Texas A&amp;M University</b>	College Station, TX
Computational Materials Science Lab, Scientific Machine Learning Lab	Sep. 2021-Dec. 2021
Advisor: Prof. Raymundo Arroyave, Prof. Ulisses Braga-Neto	
<b>Graduate Research Assistant, Georgia Institute of Technology</b>	Atlanta, GA
Multi-Scale System Engineering Research Group	Aug. 2016-Aug. 2021
Advisor: Prof. Yan Wang	
<b>Graduate Intern, Siemens Corporate Technology</b>	Princeton, NJ
Product Simulation and Modeling Group	May 2019-Aug. 2019
Mentor: Dr. Elena Arvanitis, Dr. Lucia Mirabella	
<b>Graduate Intern, Idaho National Laboratory (INL)</b>	Idaho Falls, ID
Fuels Modeling and Simulation Department	Jun. 2018-Aug. 2018
Mentor: Dr. Larry Agesen	

## Honors and Awards

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

## Publications and Creative Products

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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. Biswas, S., **Liu, D.**, & Jiang, W. (2021). 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*. (in press)
2. **Liu D.** and Wang Y. (2021) A Dual-Dimer method for training physics-constrained neural networks with minimax architecture. *Neural Networks*, **136**: 112-125.
3. **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).
4. **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.
5. 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.
6. 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.
7. **Liu D.** and Wang Y. (2019) Mesoscale multi-physics simulation of rapid solidification of Ti-6Al-4V alloy. *Additive Manufacturing*, **25**: 551-562.
8. 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.
9. **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.

10. 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.
11. **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. “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.
2. **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.
3. **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.
4. **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. Metal Additive Manufacturing Process Design based on Physics Constrained Neural Networks and Multi-Objective Bayesian Optimization. *50th SME North American Manufacturing Research Conference (NAMRC 50, 2022)*.
2. Tran A., Sun J., **Liu D.**, Wildey T., and Wang Y. Stochastic reduced-order model with temporal upscaling for uncertainty propagation in materials modeling. *Journal of Computing and Information Science in Engineering* (2021).

#### **E. Under Preparation Journal Papers**

1. **Liu D.**, Puserla P., and Wang Y. Multi-fidelity physics-constrained neural networks with minimax architecture.
2. **Liu D.** and Wang Y. Physics-constrained neural networks with minimax architecture for multiphysics problems.
3. **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**

#### **G1. 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 2<sup>nd</sup> 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 4<sup>th</sup> 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.

## **Teaching Experience**

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### **Guest Lecturer, Georgia Institute of Technology**

Spring 2020

Graduate Course: Computer-Aided Design, Number of Students: 67

- Conducted teaching practicum to deliver two 75-minute lectures
- Designed and prepared a lecture to introduce python programming and common numeric libraries
- Delivered a lecture to teach implicit surface modeling

### **Graduate Teaching Assistant, Georgia Institute of Technology**

Spring 2018-2021

Graduate Course: Computer-Aided Design, Number of Students: 56 (Spring 2018), 54 (Spring 2019), 67 (Spring 2020), 76 (Spring 2021)

- Held office hours to help students understand the course-related material and answered questions
- Led discussions, answered questions, and clarified materials on the online course forum

- Prepared and compiled resources for learning python programming language
- Instructed students to debug and identify problems in their codes
- Graded homework and provided feedback

## Proposal Writing Experience

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- Wrote a proposal for NIST Metals-based Additive Manufacturing Grant Program (MBAMGP) with Prof. Yan Wang on “*Digital Twin of Metal Additive Manufacturing for Process Monitoring and Control.*” (January 2022)
- Wrote a proposal for NSF CDS&E meta-program to the CMMI division with Prof. Raymundo Arroyave and Prof. Ulisses Braga-Neto on “*Self-Adaptive Physics-Informed Machine Learning for Process Design in Metal Additive Manufacturing.*” (September 2021)
- Wrote a white paper for ONR FOA Announcement #N00014-20-S-F002 with Prof. Yan Wang on “*Investigation of Process-Structure-Property Relationship for Additive Manufacturing with Multiphysics Simulation and Physics-Constrained Machine Learning.*” (March 2020)
- Contributed to a proposal for DARPA-SN-18-65 disruption opportunity called “The Physics of Artificial Intelligence (PAI)” with Prof. Yan Wang on “*Physics Constrained Machine Learning.*” (July 2018)
- Contributed to a proposal for SAMSUNG GRO program called “Material Informatics-Data-Driven Materials Property/Structure Prediction” with Prof. Yan Wang on “*Physics-Based Data-Driven Process-Structure-Property Relationship Exploration.*” (June 2017)

## Mentorship for Undergraduate Students

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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

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### A. Symposium/Event Organized

Committee Member ASME Computers and Information in Engineering (CIE) Student Hackathon, 2020-2021  
<https://asmehackathon.github.io/>

### B. Journal/Conference Proceedings Review

Guest Reviewer Additive Manufacturing

Guest Reviewer	Computational Materials Science
Guest Reviewer	Engineering Research Express
Guest Reviewer	Expert Systems with Applications
Guest Reviewer	International Journal of Production Research
Guest Reviewer	Journal of Computing and Information Science in Engineering
Guest Reviewer	Journal of Thermal Science
Guest Reviewer	Materials Research Express
Guest Reviewer	Modelling and Simulation in Materials Science and Engineering
Guest Reviewer	ASME International Design Engineering Technical Conference & Computers and Information in Engineering Conference (IDETC/CIE), 2017-2021
Guest Reviewer	North American Manufacturing Research Conference (NAMRC), 2022

#### **C. Proposals Review**

Reviewer	Georgia Tech President's Undergraduate Research Awards, June 19, 2020
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#### **D. Academic Program Development**

Guest Lecturer	International Summer Exchange Program, Georgia Tech Manufacturing Institute, Summer 2017
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#### **E. Professional Memberships**

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