

Wenchao Zhou

CONTACT INFORMATION

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EDUCATION

Ph.D., Mechanical Engineering Aug. 2009 ~ May 2014

Georgia Institute of Technology, Atlanta, GA

Dissertation: Interface Dynamics in Inkjet Deposition

Advisor: Professor David W. Rosen

M.S., Mechanical Engineering Sept. 2006 ~ July, 2009

Xi'an Jiaotong University, Xi'an, China

Thesis: Capacitive Micromachined Ultrasonic Transducer based on Post-CMOS process

Advisors: Professor Zhuangde Jiang

B.S., Mechanical Engineering Sept. 2002 ~ July, 2006

Huazhong University of Science and Technology, Wuhan, China

Thesis: Design and Simulation of a 3-D Laser Scanner of Shoe Last

EMPLOYMENT

University of Arkansas, Fayetteville, AR, Aug. 2014 ~

- Assistant Professor in the Department of Mechanical Engineering

University of Arkansas, Fayetteville, AR, Sept. 2015 ~ Jun. 2018

- Assistant Professor and 21st Century Endowed Professorship in the Department of Mechanical Engineering

AlpZhi Inc. (a spin-off from Georgia Tech), Atlanta, GA, July 2013 ~ June 2014

- Chief Research Engineer leading the development of a microlens fabrication technology based on 3D printing

Oak Ridge National Laboratory, Oak Ridge, TN, May 2012 ~ Aug. 2012

- HERE research fellow on additive manufacturing technology for electronics

Shenzhen Institute of Advanced Technology, Chinese Academy of Science, Shenzhen, China, Aug. 2007 ~ Sept. 2008

- Visiting student on Capacitive Micromachined Ultrasonic Transducer
- Assistant administrator of Integrated Circuit Research Center
Huazhong University of Science and Technology, Wuhan, China, Jan. 2004 ~ June 2006
- Dean's assistant on college website development, operation and maintenance
Shenzhen Leadwell Technology CO.,LTD, Shenzhen, China, May 2005 ~ Aug. 2005
- Mechanical engineer on developing a hydraulic system for injection molding machine

GRANTS

- SBIR Phase I: Exposure Controlled Projection Lithography for Fabrication of Physical Shaped GRIN Optics, PI, National Science Foundation, \$178,769.00, July 2013.
- Drop-on-Demand Printing at Megahertz Frequency, PI, University of Arkansas, \$75,000, Sept. 2015.
- Bypassing the Limit of Sintering Temperature for Printed Electronics with a Microheater Array, PI, Oak Ridge Associated Universities, \$10,000, June 2016.
- Acquisition of a Rheometer for Additive Manufacturing Process Research, University of Arkansas Honors College, PI, \$7000, Sept. 2016.
- MRI: Acquisition of a micro-computed tomography system for advanced imaging and inter-disciplinary multi-user access for the University of Arkansas and the US Interior Highlands, Co-PI, National Science Foundation, \$687,161.00, Sept. 2017.

SERVICE

- ASME Manufacturing Engineering Division Communication Officer, June 2015 ~ now
- Co-organizer of Convergence of Additive Manufacturing with Micro/Nano-Technologies for ASME International Mechanical Engineering Congress and Exposition. Dec. 2017
- Co-organizer of symposium on Recent Advances in Functional Materials and 2D/3D Processing for Sensors and Electronic Applications for TMS 2019, April 2018
- Additive Manufacturing Standard Committee organized by America Makes & ANSI Additive Manufacturing Standardization Collaborative, May 2016

SELECTED HONORS AND AWARDS

- Winner of 2017 America Makes Additive Manufacturing Curricula Challenge
- **2017 Rapid Prototyping Journal Literati Awards:** Outstanding Paper winner of the year by Rapid Prototyping Journal
- **2016 Ralph E. Powe Junior Faculty Enhancement Award,** Oak Ridge Associated Universities, May 2016
- **21st Century Endowed Professorship,** University of Arkansas, Sept. 2015

- **Highly Commended Award for the 2013/14 Emerald Engineering Outstanding Doctoral Research in Additive Manufacturing** (Sponsored by Emerald Group Publishing)
- **2013 Chinese Government Award for Outstanding Oversea Students** (Global competition among the graduate students in all majors)
- **Best Presentation Award**, The Twenty Forth Annual International Solid Freeform Fabrication Symposium, Aug. 2013
- **Higher Education Research Experiences (HERE) Fellowship Award**, Oak Ridge National Lab, April, 2012
- **Best Paper Award**, International Conference on Advanced Research in Virtual and Rapid Prototyping 2011, Sept. 2011
- **Graduate Fellowship**, Xi'an Jiaotong University, Sept. 2006
- **The Most Influential Person in college**, Huazhong University of Sci&Tech, 2004
- **University Academic Excellence Award**, Huazhong University of Sci&Tech, 2004
- **Best Student Leader Award**, Huazhong University of Sci&Tech, Dec. 2003

PATENTS

- Wenchao Zhou, Austin Van Horn, Nicholas Holt, Lucas Galvan Marques, "Microheater Array Powder Sintering – A New Additive Manufacturing Method", April 2017 Patent Pending
- Wenchao Zhou, Lucas Galvan Marques, Robert Austin Williams, "A Cooperative 3D Printing Platform", May 2017, Patent Pending
- Wenchao Zhou, Chao Sui, "High-frequency multi-pulse inkjet", April 2018, Patent Pending

PUBLICATIONS

Education Article

- **Wenchao Zhou** (2018). 3D printing. In AccessScience. McGraw-Hill Education. <https://doi.org/10.1036/1097-8542.694300> (**Invited**)

Journal Papers

- Nicholas Holt and Wenchao Zhou. "Design and Fabrication of an Experimental Microheater Array Powder Sintering Printer." JOM (2018): 1-8. (**Invited**)
- Jace McPherson and **Wenchao Zhou**, "A Chunk-based Slicer for Cooperative 3D Printing", Rapid Prototyping Journal, Accepted.

- Nicholas Holt, Ausitn Van Horn, Mahsa Montazeri, and **Wenchao Zhou**. "Microheater array powder sintering: A novel additive manufacturing process." *Journal of Manufacturing Processes* 31 (2018): 536-551.
- Nicholas Holt, Lucas Galvan Marques, Austin Van Horn, Mahsa Montazeri, and **Wenchao Zhou**. "Fabrication and control of a microheater array for Microheater Array Powder Sintering." *The International Journal of Advanced Manufacturing Technology* (2017): 1-8.
- John C. Miers, and **Wenchao Zhou**. "Droplet formation at megahertz frequency." *AIChE Journal* 63.6 (2017): 2367-2377.
- Austin VanHorn, **Wenchao Zhou**, Design and optimization of a high temperature microheater for inkjet deposition, *International Journal of Advanced Manufacturing Technology*, 86.9-12 (2016): 3101-3111.
- **Wenchao Zhou**, Frederick A. List III, Chad E. Duty, and Sudarsanam S. Babu, "Fabrication of Conductive Paths on a Fused Deposition Modeling Substrate using Inkjet Deposition", *Rapid Prototyping Journal* 22.1 (2016) (**Outstanding Paper Winner of the Year of Rapid Prototyping Journal**).
- **Wenchao Zhou**. "Lattice Boltzmann simulation of coalescence of multiple droplets on non-ideal surfaces." *Physical Review E* 92.5 (2015): 053307.
- Hassan Rezayat, **Wenchao Zhou**, Akawat Siriruk, Dayakar Penumadu, S Suresh Babu, "Structure-Mechanical Property Relationship in Fused Deposition Molding", *Materials Science and Technology* 2015; 31(8), 895-903.
- **Wenchao Zhou**, Frederick A. List III, Chad E. Duty, and Sudarsanam S. Babu, "Sintering Kinetics of Inkjet Printed Conductive Silver Lines on Insulating Plastic Substrate", *Metallurgical and Materials Transactions B*, 2015; 46(3), 1542-1547
- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, " *Shape Evolution of Multiple-droplet Interaction upon Impinging on a Solid Surface* ", *Rapid Prototyping Journal* 21.4 (2015): 373-385.
- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, " *Lattice Boltzmann Simulations of Multiple Droplet Interaction Dynamics* ", *Physical Review E*, vol. 89.3, pp. 033311, 2014. (Selected into the "Kaleidoscope" on the journal website)
- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, "*What controls dynamics of droplet shape evolution upon impingement on a solid surface?*", *AIChE Journal*, vol. 59, pp. 3071–3082, 2013

- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, " *Droplet Impingement Dynamics in Ink-Jet Deposition*", Journal of Virtual and Physical Prototyping, vol. 7, pp. 49-64, 2012
- Ting Yu, **Wenchao Zhou**, Peng Xu, Fengqi Yu, and Qin Qian, " *Theoretical investigation on the dynamic performance of CMUT for design optimization* ", Acta Mechanica Sinica, vol. 26, pp. 99-110, 2013

Conference Papers

- Laxmi Poudel, Zhenghui Sha, **Wenchao Zhou***, Mechanical strength of chunk-based printed parts for cooperative 3D printing, 46th SME North American Manufacturing Research Conference, NAMRC 46, Texas, June 18-22, 2018
- Nicholas Holt, Ausitn VanHorn, Mahsa Montazeri, **Wenchao Zhou***, Microheater Array Powder Sintering: A Novel Additive Manufacturing Process, 28th International Solid Freeform Fabrication Symposium, Austin, Texas, August 7-9, 2017
- Nicholas Holt, Lucas Galvan Marques, Ausitn VanHorn, Mahsa Montazeri, **Wenchao Zhou***, Fabrication and Control of a Microheater Array for Microheater Array Powder Sintering, 28th International Solid Freeform Fabrication Symposium, Austin, Texas, August 7-9, 2017
- Lucas Galvan Marques, Robert Austin Williams, **Wenchao Zhou***, A Mobile 3D Printer for Cooperative 3D Printing, 28th International Solid Freeform Fabrication Symposium, Austin, Texas, August 7-9, 2017
- Jace McPherson, Adam Bliss, Flora Smith, Edmund Harriss, **Wenchao Zhou***, A Slicer and Simulator for Cooperative 3D Printing, 28th International Solid Freeform Fabrication Symposium, Austin, Texas, August 7-9, 2017
- Jason Steck, Rolando Morales-Ortega, Jacob Currence, **Wenchao Zhou***, A Mobile Gripper Robot for Cooperative 3D Printing, 28th International Solid Freeform Fabrication Symposium, Austin, Texas, August 7-9, 2017
- Jacob Currence, Rolando Morales-Ortega, Jason Steck, **Wenchao Zhou***, A Floor Power Module for Cooperative 3D Printing, 28th International Solid Freeform Fabrication Symposium, Austin, Texas, August 7-9, 2017
- **Wenchao Zhou**, Lattice Boltzmann Simulation of Multiple Droplet Interaction on Non-ideal Surfaces for Inkjet Deposition, 26th International Solid Freeform Fabrication Symposium, Austin, Texas, August 10-12, 2015
- Austin Van Horn, **Wenchao Zhou***, Design and Optimization of a High Temperature

Microheater for Inkjet Deposition, 26th International Solid Freeform Fabrication Symposium, Austin, Texas, August 10-12, 2015

- Jiyu Cai, Austin Vanhorn, Casey Mullikin, Jennifer Stabach, Zach Alderman, and **Wenchao Zhou***, 4D Printing of Soft Robotic Facial Muscles, 26th International Solid Freeform Fabrication Symposium, Austin, Texas, August 10-12, 2015
- John Miers, **Wenchao Zhou***, Inkjet Printing at Megahertz Frequency, , 26th International Solid Freeform Fabrication Symposium, Austin, Texas, August 10-12, 2015
- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, "*On a Three-Dimensional Lattice Boltzmann Model of Droplet Impingement for Ink-Jet Deposition*", 6th International Conference on Advanced Research in Virtual and Rapid Prototyping, Leiria, Portugal, October 1-5, 2013.
- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, "*Lattice Boltzmann Simulations of Multiple Droplet Interactions During Impingement on the Substrate*", 24th International Solid Freeform Fabrication Symposium, Austin, Texas, August 12-14, 2013. (**Best Presentation Award**).
- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, "*Shape Characterization for Droplet Impingement Dynamics in Ink-jet Deposition*", ASME 2012 International Design Engineering Technical Conference & Computers and Information in Engineering Conference IDETC/CIE-2012, Chicago, Illinois, August 12-15, 2012.
- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, "*Shape evolution of droplet impingement dynamics in Ink-Jet manufacturing*", 22nd International Solid Freeform Fabrication Symposium, Austin, Texas, USA, August 8-10, 2011.
- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, "*Droplet Impact Dynamics in Ink-Jet Manufacturing*", 5th International Conference on Advanced Research in Virtual and Rapid Prototyping, Leiria, Portugal, September 28-October 1, 2011 (**Best Paper Award**).
- David W. Rosen, F. Levent Degertekin, Andrei G. Fedorov, Drew Loney, **Wenchao Zhou**, "*Drop-on-demand deposition of complex fluids for 3D manufacturing*", NSF CMMI Research & Innovation Conference "Engineering for Sustainability and Prosperity", Atlanta, GA, USA, January 4-7, 2011.
- **Wenchao Zhou**, Dazhong Wu, Xiaoyu Ding, David W. Rosen, "*Customer Co-design*

of Computer Mouse for Mass Customization without Causing Mass Confusion", 2010 International Conference on Manufacturing Automation, Hong Kong, China, Dec. 13-15, 2010, pp.8-15.

- **Wenchao Zhou**, Drew Loney, Andrei G. Fedorov, F. Levent Degertekin, David W. Rosen, "*Impact Of Polyurethane Droplets on a Rigid Surface for Ink-Jet Printing*", 21st International Solid Freeform Fabrication Symposium, Austin, Texas, USA, August 9-11, 2010. pp. 524-538.
- Drew A. Loney, **Wenchao Zhou**, David W. Rosen, F. Levent Degertekin, Andrei G. Fedorov, "*Acoustic Analysis of Viscous Fluid Ejection Using Ultrasonic Atomizer*", 21st International Solid Freeform Fabrication Symposium, Austin, Texas, USA, August 9-11, 2010. pp. 168-180.
- **Wenchao Zhou**, Ting Yu and Fengqi Yu, "*Calculation of equivalent parameters in CMUT 1-D theoretical model*", 2008 IEEE International Ultrasonics Symposium, Beijing, China, Nov. 2-5, 2008.
- **Wenchao Zhou**, Ting Yu and Fengqi Yu, "*A 1-D Theoretical Receiving Model of CMUT*", 2008 International Conference on Intelligent Computation Technology and Automation, IEEE Computer Society, Changsha, Hunan, P.R. China, Oct. 22-25, 2008.
- **Wenchao Zhou**, Ting Yu and Fengqi Yu, "*A 1-D Lumped Theoretical Model for CMUT*", IEEE/ASME International Conference on Advanced Intelligent Mechatronics, Xi'an, P.R. China, July 2-5, 2008.

SELECTED INVITED TALKS

- From 3D Printing to Digital Manufacturing, Manufacturing Demonstration Facility of Oak Ridge National Lab, 2018, Knoxville, TN
- From 3D Printing to Digital Manufacturing, University of Texas at Dallas, 2018, Dallas, TX
- Microheater Array Powder Sintering: A New Process for Printed Electronics, TMS 2018, Phoenix, AZ
- 3D Printing–Future of Manufacturing: The Fourth Wave of Human Civilization, Kansas State University, 2016, Manhattan, KS
- Advances in 3D Printing, IEEE Ozark Section Meeting, 2016, Fayetteville, AR
- Interface Dynamics in Inkjet Deposition and Beyond, University of Illinois at Urbana-Champaign, 2014, Urbana Champaign, IL

- Interface Dynamics in Inkjet Deposition and Beyond, University of Maryland, 2014, College Park, MD
- Interface Dynamics in Inkjet Deposition and Beyond, University of Utah, 2014, Salt Lake City, UT

RESEARCH EXPERIENCE

Cooperative 3D Printing

Principle investigator, The AM³ Lab, January 2016 ~ Now

- Developing a new scalable digital fabrication platform with a swarm of printhead-carrying mobile robots to work cooperatively to 3D print and assemble products.

Microheater Array Powdering Sintering (MAPS)

Principle investigator, The AM³ Lab, August 2015 ~ Now

- Developing a new scalable digital fabrication process for printed electronics and additive manufacturing with significant energy savings

Megahertz Inkjet Printer

Principle investigator, The AM³ Lab, August 2014 ~ Now

- Developing inkjet printer that can potentially print ~100 times faster than current inkjet printers

4D Printing of Soft Robotics

Principle investigator, The AM³ Lab, August 2014 ~ Now

- Developing 4D printing process using dielectric elastomers

High Speed Powder Feeding System

Principle investigator, The AM³ Lab, August 2014 ~ August 2015

- Developing high speed powder feeding system for powder-bed based 3D Printing Processes

3D Micro Printer

Principle investigator, The AM³ Lab, August 2014 ~ August 2016

- Developed a extrusion-based 3D printer that can print with precision at micron level

Low-cost Multi-material Inkjet 3D Printer

Principle investigator, The AM³ Lab, August 2014 ~ December 2016

- Developing low-cost 3D inkjet printer that is capable of print both structural and electronics materials simultaneously.

Exposure Controlled Projection Lithography for Fabrication of Physical Shaped GRIN Optics

Principle investigator (NSF SBIR project), Alpzhi Inc., July 2013 ~ July 2014

- Developed new materials for GRIN optics
- Developed optical system for refractive index profile measurement
- Developed new fluorescence imaging technique to visualize the diffusion process of material additives and quantify their diffusion and polymerization rates experimentally
- Hold weekly meeting with team to monitor progress and plan for next week

Inkjet printing for 3-D Manufacturing

Graduate research assistant (PhD Thesis), Georgia Tech, Aug. 2009 ~ July 2013

- Developed a novel nozzle technology to overcome limitations of commercial nozzles
- Fabricated our developed nozzle plates in cleanroom using MEMS fabrication methods
- Developed a numerical model for droplet impact dynamics and validated the model
- Developed a novel metric to quantify droplet shape to study droplet shape evolution
- Developed understanding of what controls the interface evolution for a single droplet
- Developed a novel numerical solver to study multiple droplets deposition process

Make conductive lines on polymer substrate with inkjet printing

Research fellow, Oak Ridge National Lab, May 2012 ~ Aug. 2012

- Developed surface processing techniques for textured polymer substrates
- Identified the problems for non-conductivity of printed lines on the polymer substrates
- Found out different engineering solutions for the non-conductivity problems
- Improved conductivity by studying effects of different process parameters
- Conducted experiments to understand the physics of droplet drying process

Parallelization of a 2D viscous compressible Navier-Stokes solver

Team leader (High Performance Computing class), Georgia Tech, Aug. 2011~ Dec. 2011

- Developed a solver to simulate super-sonic flow around a simplified airfoil using C++
- Parallelized the numerical solver with MPI and OpenMP and speed up by 3.66x

Customer co-design of computer mouse for mass customization

Team leader, Georgia Tech, Jan. 2010 ~ May 2010

- Geometric modeling of the computer mouse with engineering design parameters
- Developed a CAD software to provide customers a simple interface to design
- Developed a manufacturing module to generate both CNC tool path and STL file

Capacitive micromachined ultrasonic transducer based on post-CMOS process

Research assistant (Master thesis), Shenzhen Institute of Advanced Technology, Chinese Academy of Science, Jan. 2010 ~ May 2010

- Developed a simplified analytical model for the acoustics of the transducer
- Modeling the coupling of structural mechanics, acoustics, and fluid dynamics
- Optimized the design parameters with FEM model and our analytical model
- Developed the micro-fabrication processes and designed the layouts with L-Edit
- Simulated the fabrication processes with commercial software CoventorWare

Design and simulation of a 3-D laser scanner of shoe last/mold

Research assistant (Undergraduate thesis), HUST, Sept. 2005 ~ June 2006

- Simulated the laser scanning process and obtained scanned images of a shoe last
- Calibrated the cameras by scanning calibration blocks
- Developed a new algorithm to process the calibration images to calibrate the cameras
- Processed the scanned images of the shoe last and obtained 3D point cloud
- Reconstructed the 3D shoe last with the obtained point cloud

TEACHING EXPERIENCE

Instructor, Computer Methods

Department of Mechanical Engineering, University of Arkansas, Fayetteville
Instructor Evaluation: 4.00 out of 5 (Fall 2017)

Instructor, Additive Manufacturing

Department of Mechanical Engineering, University of Arkansas, Fayetteville
Instructor Evaluation: 4.56 out of 5 (Spring 2016)

Instructor, Fluid Mechanics

Department of Mechanical Engineering, University of Arkansas, Fayetteville
Instructor Evaluation: 4.78 out of 5 (Summer 2016)

SKILLS

- Software: Matlab, COMSOL, ANSYS, Solidworks/Unigraphics, Mathematica, LAMMPS
- Programming languages: Matlab M; C; Fortran; C++; Java
- Hardware: Robotics, Embedded System, Cleanroom fabrication equipments, including Spinner, PECVD, Sputter, Profilometer, SEM, RIE, ICP, Mask aligner,

microscope, etc. Stereolithography machine Viper, Objet Eden 250, Arduino, embedded electronics, etc.

CERTIFICATIONS

- Software Designer, Ministry of Personnel and Ministry of Info Industry of China, 2005
- Programmer, China Ministry of Info Industry & Japan Ministry of Econ. & Trade, 2003