

Swapnil Sinha

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Education

The Pennsylvania State University

Ph.D. Mechanical Engineering Department GPA 3.72/4
M.S. Engineering Design '17 GPA 3.72/4

University Park, PA

2017 – Present

2015 – 2017

Manipal Institute of Technology – India

B.Tech. Mechanical Engineering '15 GPA 8.32/10

Karnataka, India

2011 – 2015

Research and Work Experience

Graduate Assistant, Mechanical Engineering Department

University Park, PA

Design and development of a rig design for a future undergraduate laboratory course

2019 – 2020

- Digitally designed and analyzed a wind tunnel system with controlled air flow to allow exploration of cooling in forced air conditions by the students
- Designed and evaluated 3D printed micro-channels for the wind tunnel to showcase the impact of design on cooling
- Evaluated off the shelf pressure and temperature measurement devices, and data acquisition instruments for the system
- Successfully developed a prototype of the designed system and documented the process for course development

Graduate Researcher, Made by Design Lab

University Park, PA

Development of design guidelines for in-situ embedding via material extrusion additive manufacturing (AM)

2017 – 2019

- Developed a method to predict interfacial weld strength for polymer material extrusion parts with different cavity designs for embedding with the polymer weld theory
- Developed a computational heat transfer model for material extrusion AM process that captures deposition tool path
- Developed a digital design tool to automate design for embedding complex geometry parts by finding their optimum orientation based on cavity's volume and cross section area
- Guided two undergraduates during their Summer Research Program on projects that investigated a. Effectiveness of voxel-based modelling for cavity designs & b. Explored reinforcement via material extrusion additive manufacturing
- Performed study to identify differences in creativity of ideas generated for additive manufacturing, as compared to traditional manufacturing. Compared the expert rating method with the Shah & Vargas Hernandez method to rate creativity

Graduate Researcher, School of Engineering Design Technology and Professional Programs (SEDAPP)

University Park, PA

Analysis and design of digital interface to support analysts in allocating resources in complex environment

2016 – 2017

- Developed an informal curriculum for a mobile makerspace M.A.K.E.3D aimed at developing interest and retention in STEAM (Science, Technology, Engineering, Arts, and Mathematics) through Additive Manufacturing Technology
- Deployed the mobile makerspace at different campuses and collected survey data pre and post exposure to the makerspace
- Determined the key exposure variables that influenced students' self-ratings through analysis of the surveys and observations

User Experience Researcher, Penn State Interaction Design Project

University Park, PA

Design of wearable wristband to reduce hand-to-face contact in biohazardous environments

2016

- Managed and conducted stakeholder interviews to define the project's scope, define user needs, and receive user feedback
- Researched patents, laboratory safety protocols and protective equipment, behavior modification methods, alarm systems, and proximity sensors; created personas and use-case scenarios to inform device design
- Completed content analysis on 16 patents and conducted Wizard of Oz studies to design proof-of-concept prototype

Product Designer, Penn State Engineering Design Studio Project

University Park, PA

Design and evaluation of possible ways to collect weight distribution on foot while using orthopedic CAM boot

2015

- Brainstormed ideas and implemented engineering design to evaluate and select feasible solutions
- Developed prototypes of the selected ideas and evaluated effectiveness by comparing the output from the sensors

Product Developer, Manipal Institute of Technology Senior year Project

Karnataka, India

Design of a low cost mechatronic prosthetic arm that enabled wrist rotation through robotics

2015

- Conducted market research, interviews with users and health care providers to assess limitation of existing prosthetic arms
- Conducted material testing to evaluate material strength of 3D printed structures in order to reduce overall weight
- Utilized design of machinery and kinematic analysis to design and prototype a working prosthetic arm with robotic wrist rotation allowing pronation and supination motions

Mechanical Design Head, Manipal Institute of Technology Robotics Team (ROBOMANIPAL)

Karnataka, India

Lead mechanical designer of robots representing university at national level ROBOCON robotics competition

2012 – 2014

- Trained and managed a team of ~30 undergraduates in using of machine shop dedicated to build robots
- Designed, analyzed, and manufactured mechanisms for robots, simulated test environments, and showcased them for funding opportunities

Teaching Experience

Graduate Teaching Assistant, Mechanical Engineering Department

University Park, PA

Assistance with theoretical development and experimentation in Heat Transfer for Senior students

2019 – 2020

- Responsible for grading, guiding, and supervising experimentation to develop understanding of Heat Transfer analysis

Guest Lecturer, Design for Additive Manufacturing by Dr. Nicholas A. Meisel, Penn State

University Park, PA

Prepared and presented lecture material for Dr. Nicholas A. Meisel's graduate-level Design for Additive Manufacturing course

2019

- Introduced in-situ embedding with additive manufacturing through examples applications
- Led students in execution of short exercises of brainstorming and design thinking

Faculty Leader, Summer by Design at Tecnun Universidad de Navara

San Sabastian, Spain

Led undergraduate students for a two-week student exchange program by Penn State

2017

- Assisted students in design, development, and prototyping of ideas for the summer by design course

Teaching Assistant, EDSN 100, College of Engineering, Penn State

University Park, PA

Assistant to instructors for computer aided design (CAD) training and workshop for freshmen year engineering

2017

- Conducted training sessions for structural finite element analysis with Solidworks
- Instructed students on the Engineering Design process by conducting a workshop on "brainstorming as a team"

Peer-Reviewed Journal Publications (scholar.google.com/citations?user=8lurGqEAAAAJ&hl)

- (1) **S. Sinha** and N. A. Meisel, "Predicting Material Properties for Embedded Structures Created with Polymer Additive manufacturing," Additive Manufacturing Journal, 2020.
- (2) M. Malviya, **S. Sinha**, C. Berdanier, and N. A. Meisel, "Digital Design Automation to support In-Situ Embedding of Functional objects in Additive Manufacturing", Journal of Mechanical Design, 2020.
- (3) Alvaro Jordan, A. D. Knochel, N.A. Meisel, K. Reiger, and S. Sinha, "Making on the Move: Mobility, Makerspaces, and Transdisciplinary Art Education," The International Journal of Arts and Design Education, iJADE-May-19-090, 2020.
- (4) **S. Sinha**, K. Reiger, A. D. Knochel, N. A. Meisel, "Mobile Making Platform for 3D Printing Education: Evaluating Impact of Key Session Variables on Student Awareness and Engagement," In Print, The International Journal of Engineering Education, 2020.
- (5) **S. Sinha** and N. A. Meisel, "Influence of process interruption on mechanical properties of material extrusion parts," Rapid Prototyp. J., p. RPJ-05-2017-0091, 2018.

Peer-Reviewed Conference Publications

- (6) **S. Sinha** and N. A. Meisel, "Impact of Embedding Cavity Design on Thermal History between Layers in Polymer Material Extrusion Additive Manufacturing," Solid Free. Fabr. 2019 Proc. 30th Annu. Int., Austin, Texas.
- (7) M. Malviya, **S. Sinha**, and N. A. Meisel, "Digital Design Automation to Support In-Situ Embedding of Functional Components in Additive Manufacturing," pp. 1–10, ASME 2019 International Design Engineering Technical Conferences and Information in Engineering Conference, Anaheim, California.
- (8) **S. Sinha** and N.A. Meisel, "Quantifying effects of Embedding Component Orientation on Flexural Properties in Additively Manufactured Structures," Solid Free. Fabr. 2018 Proc. 29th Annu. Int., Austin, Texas.
- (9) **S. Sinha**, K. Rieger, A. D. Knochel, and N. A. Meisel, "Design and Preliminary Evaluation of a Deployable Mobile Makerspace for Informal Additive Manufacturing Education," pp. 2801–2815, Solid Free. Fabr. 2017 Proc. 29th Annu. Int., Austin, Texas.
- (10) **S. Sinha**, H. Chen, N. A. Meisel, and S. R. Miller, "Does designing for additive manufacturing help us be more creative? An exploration in engineering design education," pp. 1–12, ASME 2017 International Design Engineering Technical Conferences and Information in Engineering Conference, Cleveland, Ohio.
- (11) **S. Sinha** and N. A. Meisel, "Influence of Embedding Process on Mechanical Properties of Material Extrusion Parts," Solid Free. Fabr. 2016 Proc. 27th Annu. Int., pp. 847–863, 2016.

Skills

Additive Manufacturing, Material Testing, Design of Experiments, Data Acquisition, Polymer Chemistry, Material Characterization, Data Analysis, Statistics, Finite Element analysis (FEA), Mathematical Modelling, Heat Transfer Analysis, Product Development, Engineering Design, Project Management

Software: MATLAB, SolidWorks, Abaqus, COMSOL Multiphysics, Ansys, SPSS, PTC Creo (ProE), CATIA, C++, R, LabVIEW,

Systems: Tensile and Flexural strength testing through screw driven testing rig (Instron and MTS), Material Extrusion, Material Jetting, Stereolithography (SLA) Additive Manufacturing Systems

Awards and Membership

- Rising Stars in Mechanical Engineering – Stanford University (2019)
- NSF student support recipient – Solid Freeform Fabrication (SFF) Symposium, Austin, TX (2019 & 2018)
- Best Poster award in undergraduate exhibition, Penn State (2018)
- Member of Society of Women Engineers (since 2017)
- Winner of "All-Terrain Vehicle" Competition, Manipal Institute of Technology, Karnataka, India (2011)