

SAROJ SUBEDI

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EDUCATION:

North Carolina State University <i>Ph.D. in Mechanical Engineering</i> Dissertation Topic : <i>"Investigating and Controlling Energy Input in Traditional and Scrolling DLP Systems for Enhanced Dimensional Accuracy and Consistent Mechanical Properties"</i> <u>Committee members</u> : Dr. Henry Ware (Chair), Dr. Tim Horn, Dr. Jong Eun Ryu, Dr. Orlin Velev	Expected Graduation: May 2026 GPA : - 4.00/4.00
North Carolina State University <i>Master's in Mechanical Engineering</i>	Graduated : June 2024 GPA : - 4.00/4.00
The University of Mississippi, Honors College <i>Bachelor of Science in Mechanical Engineering (BSME)</i> Honors Thesis : <i>"Feasibility Study of Portable Solar Powered Blood Storing Refrigerator"</i>	Graduated: May 2021 GPA: - 3.89/4.00

RESEARCH EXPERIENCE:

North Carolina State University – Mechanical and Aerospace Department (MAE) <i>PhD Researcher – Digital Manufacturing and Polymeric Materials (DMPL) Lab</i>	<i>Aug 2021 – Present</i>
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Development of Static and Scrolling DLP systems

- Designed, fabricated and assembled the complete static DLP 3D printer system with integrated hardware-software control using LabVIEW, enabling user-defined parameter input, synchronized z-stage motion, and accurate image projection.
- Developed and implemented a custom Scrolling DLP 3D printer platform using Python, incorporating real-time coordination of gantry motion and image scrolling to enable large-area fabrication.

Automated System for Mitigation of Non-uniform illumination in DLP Systems

- Developed fully automated system to obtain grayscale masks for uniform illumination by integrating two linear stages controlled by Arduino, power meter sensor and image projection algorithm using LabVIEW
- Developed image processing programs for pixelwise grayscale adjustment and automatic border detection and dimension acquiring program using MATLAB and Python

Solidification-model Based Optimization for Improving Features Accuracy and Strength

- Formulated a physics-based solidification model to simulate voxel-wise energy accumulation in DLP 3D printing using Gaussian light distributions, enabling accurate prediction of cured geometry and crosslinking density.
- Developed a dual-objective optimization framework in MATLAB to simultaneously minimize overcuring (for dimensional accuracy) and maximize core energy (for green strength), implemented through grayscale modulation of sliced images.
- Validated the optimization model through experimental printing trials, comparing optimized and non-optimized samples in terms of dimensional fidelity and mechanical integrity

Functional Material Fabrication via Vat Photopolymerization

- Development of materials and optimization of parameters for production of superhydrophobic and superomniphobic surfaces.
- Characterized photopolymer materials and optimized printing parameters to fabricate high-sensitivity fluorescent sensors for potential bio-sensing applications.
- Studied the effect of surfactants on particle clustering and distribution under acoustic stimulation to develop functionally gradient materials utilizing patterned nano/micro particles embedded in the photopolymer matrices.

Undergraduate Research Assistant

- Investigated atomic-level sintering mechanisms for In-space additive manufacturing of metals/alloys using computational framework for modeling, simulation, and prediction of metal/alloy nanoparticle sintering with LAMPPS
- Produced and analyzed results of responses/behaviors of Ti/Al core shell particles under different temperature and pressure

TEACHING/MENTOR EXPERIENCE**Instructor - Mechanical Engineering Senior Design, NCSU***Aug 2021 - present*

- Delivered lectures, guided and coordinated senior design teams including a total of 120 students throughout phases of brainstorming, planning, and fabrication of prototypes for 4 consecutive years
- Coordinated communications between sponsors (*Daimler Trucks, John Deere, NC State Horticulture Department*), professors and students and conducted meetings and presentations

Instructor – Structures and Instrumentation Lab, NCSU*Aug 2021 – May 2022*

- Demonstrated Lab experiments, guided & supervised about 40 students and assessed weekly assignments

Mentor – Digital Manufacturing and Polymeric Materials Lab*Aug 2021 – present*

- Supervised and directed the research activities of 4 undergraduate students, providing mentorship and guidance in projects involving development of multi-scale DLP printer and characterization of photopolymer materials

INDUSTRY EXPERIENCE**ABB Corporate Research Center, Raleigh, NC***May 2025 – Aug 2025**Multiphysics R & D Intern*

- Implemented coupled Electromagnetic–thermal–mechanical simulation workflow using Ansys Maxwell, Icepack, and Mechanical to evaluate Lorentz-force-induced deformation in busbar assemblies under short-circuit conditions.
- Optimized laminated busbar and insulation designs through iterative Multiphysics simulations and design ideation to reduce stress and thermal hotspots.
- Designed and prototyped ergonomic clamshells for a handheld power tool using SolidWorks, integrating internal components (motor, load cell, solenoid, screen, PCB) and refining screen placement, weight distribution, and grip symmetry.
- Researched and sourced compact electromechanical components (e.g., solenoids, through-hole load cells) and incorporated them into functional design layouts to support manufacturability and cost-efficiency goals for the product team.

Rapid Shape GmbH, Raleigh, NC*June 2024 – Aug 2024**Application Engineering Intern*

- Diagnosed, repaired, and optimized 3D printers and post-processing equipment (Straumann and RapidShape printers, Pro Wash, and Pro Cure) through hands-on mechanical and electrical troubleshooting.
- Optimized printing parameters based on material behaviors to resolve print failures and align with customer requirements, ensuring high-quality part production.
- Performed hardware repairs, calibrations, and regular software updates to restore functionality, enhance performance, and maintain seamless machine operation.

ACADEMIC SERVICE

1. **Peer Reviewer**, *International Solid Freeform Fabrication (SFF) Symposium*, 2023, Austin, TX – 2 Conference papers
2. **Judge**, *2025 North Central NC Region 5 Science & Engineering Fair*, Jamestown, NC – High school level research poster presentations

SELECTED COURSE PROJECTS:

Graduate:

Automated removal of support structures from 3D printed parts using DLP printer with dual UR5 Robot arms

- Engineered a collaborative robotic system integrating two UR5 arms through MQTT protocol and ROS2 packages in Python, achieving synchronized operation where one arm hold parts printed using DLP printer while the other removed supports, enhancing automation and efficiency in 3D printing applications

Investigation of Powder Characteristics and Microstructural Evolution of Laser Printed Ti-15Mo Samples

- Optimized the printing parameters for better yield with least porosity in laser printed Ti-15 Mo samples from powder prepared with mechanical alloying through numerical modeling along with powder and microstructure characterization techniques like LECO analysis, SEM image analysis, optical image analysis, and microhardness testing.

Ecofriendly – Air Powered – Seedpods Disposal Rocket Project

- Designed and fabricated the prototype of portable, cost effective, ecofriendly, and easy to use seedpods disposing rocket using various 3D printing processes (FDM, SLA, and Powder bed fusion)

Designing a Practical Free-floating Buoy for Harvesting wave energy

- Designed a practical free-floating buoy with permanent magnet-based system for harvesting wave energy by applying modeling, analysis and design principles learnt in Design of Electromechanical System Course

Undergraduate:

Design Impact Reducing Biomedical Test Tube Rack – Abbott Laboratories

- Designed and modified test tube rack to reduce the sloshing of fluids during general handling in biomedical environment by employing Sorbothane – high impact absorbing material

Portable Ventilator

- Designed and modelled a significantly affordable and battery-operated portable ventilator from a conventional Bag Valve Mask (BVM) using the crank and slider mechanism

Feasibility Study of Portable Solar Powered Blood Storing Refrigerator

- Studied feasibility of powering a portable blood storing refrigerator by using the solar panel placed on the top of the product

TECHNICAL SKILLS:

Prototyping Software: Solid works, Autodesk Inventor, AutoCAD, Creo/Pro-E, Netfabb

Analysis Software: Ansys, ABAQUS, MS Excel, SAP2000, COMSOL

Programming Languages: LabVIEW, MATLAB, Python, Simulink

Miscellaneous: Arduino, Connected Components Workbench, ROS2

AWARDS AND MERITS:

- Leon Memorial Scholarship, MAE NCSU, 2025
- IMAT Travel Grant, 2023
- NSF sponsored SFF registration fee waiver award, 2023
- 2nd Place Winner of NCSU MAE poster presentation, 2023
- Graduate Merit Award, College of Engineering, NCSU, 2021
- Chancellors Honors Roll – Olemiss
- Tau Beta Phi Honors Society, Phi Kappa Phi Honors Society

INVOLVEMENTS:

- Honors College Ambassador – Olemiss
- Mentor, Robotics Club – Olemiss
- Executive Board Member, Nepalese Student Association – Olemiss
- Marketing Executive, Engineering Student Body - Olemiss

JOURNAL PUBLICATIONS:

1. **Subedi**, Liu, Wang, Shovon, Chen, Ware et al. "Multi-material vat photopolymerization 3D printing: a review of mechanisms and applications." *npj Advanced Manufacturing* (2024).
2. **Subedi**, Shovon, Ware et al. "Automated Grayscale Modulation to Enhance DLP Fabrication Accuracy by Correcting Non-uniform Illumination." *Journal of Micro-and Nano-manufacturing* (2024)
3. Zarei, **Subedi**, Pillai, Ware, Kota et al. "3D printed Superomniphobic Surfaces." *Nature Communications* (2025) **(Completed Work – Submission in Progress)**
4. **Subedi**, Ware et al. "Solidification Model-based Dual-objective Optimization for Dimensional Accuracy and Green Strength in DLP 3D printing", *Additive manufacturing* (2026) **(Anticipated - Work in Progress)**

CONFERENCE PUBLICATIONS:

1. **Subedi**, and Ware. "Modeling and Correcting Illumination Inhomogeneity over Multiple DLP Illumination Intensities for Better Fabrication Accuracy". **2023 International Solid Freeform Fabrication Symposium**. University of Texas at Austin, 2023.
2. Shovon, **Subedi**, Ware et al. " Effect of Surfactants on the Acoustic Patterning of Organic and Inorganic Microparticles in a Polymer Matrix." *ASME International Mechanical Engineering Congress and Exposition* (2024)
3. **Subedi**, Ware et al. "Solidification Model-based Dual-objective Optimization for Dimensional Accuracy and Green Strength in DLP 3D printing", *SPIE Photonics West Conference* (2026) **(Anticipated - Work in Progress)**

CONFERENCE PRESENTATIONS:

1. *Oral Presentation* : "Modeling and Correcting Illumination Inhomogeneity over Multiple DLP Illumination Intensities for Better Fabrication Accuracy" (**Solid Freeform Fabrication Symposium 2023**, An Additive Manufacturing International Conference, Austin, Texas)
2. *Oral Presentation* : "Utilization of DLP 3D printing towards superhydrophobic surfaces" (**International Materials Application and Technologies (IMAT 2023)** Conference, Detroit, Michigan)
3. **Anticipated** *Oral Presentation* : "Solidification Model-based Dual-objective Optimization for Dimensional Accuracy and Green Strength in DLP 3D printing" (**SPIE Photonics West Conference**, San Francisco, 2026)