

Shammo Dutta

Curriculum Vitae

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Google Scholar

ResearchGate

ORCID

EDUCATION

The University of Alabama (UA)

Doctor of Philosophy in Mechanical Engineering

GPA: 3.93/4.0

Lab: Smart Materials and Robotic Technologies (SMART) Lab

Advisor: Dr. Sree Kalyan Patiballa

Tuscaloosa, U.S.

Aug. 2022-Jul. 2026 (Defended)

The University of Alabama (UA)

Master of Science in Mechanical Engineering

GPA: 3.93/4.0

Tuscaloosa, U.S.

Awarded Dec. 2025

Amrita Vishwa Vidyapeetham (University)

Bachelor of Technology in Mechanical Engineering

GPA: 9.0/10.0

Amritapuri, India

Jul. 2017-Jun. 2021

RESEARCH INTERESTS

Mechanical metamaterials · Hierarchical metamaterials · Soft robotics · Inverse design · Data-driven design
· Homogenization and design optimization · Nonlinear finite element methods

RESEARCH EXPERIENCE

SMART Lab, UA

Graduate Research Assistant | Advisor: Dr. Sree Kalyan Patiballa

Tuscaloosa, U.S.

Aug. 2022-Aug. 2026

- Developed a homogenization and qualitative library-driven design framework for 3D hierarchical mechanical metamaterials to achieve target mechanical responses.
- Developed an inverse design framework for fabric-based soft inflatable actuators, mapping target deformations to optimal actuator geometry.
- Built a Python-ABAQUS integrated FEA framework for tendon-driven soft actuators, automating design optimization across tendon-routing configurations to accelerate iterative design.
- Quantified energy absorption of auxetic metamaterials in quasi-static and dynamic load settings.
- Developed a stress-based optimization framework for planar mechanical metamaterials, achieving near-uniform stress distribution and high energy absorption.

Department of Mechanical Engineering, Amrita University

Research Assistant | Advisor: Dr. Hariprasad M.P.

Amritapuri, India

Sep. 2021-Jul. 2022

- Co-authored a technical guide on computational tools for experimental mechanics, emphasizing 2D digital image correlation (DIC) for full-field deformation measurement.
- Collaborated in interdisciplinary projects analyzing stress concentrations in implant-supported structures.

- Developed lightweight load-bearing structures reinforced with strut-based auxetic metamaterials.
- Co-invented one U.S. patent, Indian patent and, communicated a high-impact journal article.

PUBLICATIONS

JOURNALS

- [J1] **Dutta, S.**, & Patiballa, S. K. (2026). Automated Design Framework for 3D Orthotropic Mechanical Metamaterials using insights from Load Flow-based Design. Manuscript in preparation.
- [J2] **Dutta, S.**, Turna, N. R., & Patiballa, S. K. (2026). Comprehensive Review of Computational Design Methods for Hierarchical Mechanical Metamaterials. Manuscript in preparation.
- [J3] Turna, N. R., **Dutta, S.**, Luong, T., Aaleti, S., & Patiballa, S. K. (2026). Influence of Shear Stiffness on Static and Dynamic Performance of Auxetic Metamaterials. Under Review *ASME Journal of Engineering Materials and Technology*.
- [J4] **Dutta, S.**, Krishnan Girish, Patiballa, S. K. (2026). A Design Framework for Compositional Hierarchical Mechanical Metamaterials via a Qualitative Unit-Cell Library. Under Review *ASME Journal of Mechanical Design*. <https://doi.org/10.48550/arXiv.2605.20219>
- [J5] **Dutta, S.**, Conzola, J., Vikas, V., & Patiballa, S. K. (2025). Development and Validation of Computational Modeling Framework for Tendon-based Soft Robotics. *ASME Journal of Mechanisms and Robotics*. <https://doi.org/10.1115/1.4069292>
- [J6] **Dutta, S.**, & Patiballa, S. K. (2025). Design Optimization for Uniform Stress Distribution in Mechanical Metamaterials Using a Maximum Material Utilization Metric. *ASME Journal of Mechanical Design*, 148(1): 011702. <https://doi.org/10.1115/1.4068956>
- [J7] Baghiana G, Manju V, Hariprasad M.P., Menon H.G., **Dutta S**, Vinod Kumar Gopal (2022) Comparison of Attachment Types in Maxillary Implant-assisted Obturators using Digital Image Correlation Analysis. *J Contemp Dent Pract*, 23(7), 695-702. <https://pubmed.ncbi.nlm.nih.gov/36440515/>
- [J8] Menon, H. G., **Dutta, S.**, Krishnan, A., M. P., H., Shankar, B. (2022). Proposed auxetic cluster designs for lightweight structural beams with improved load bearing capacity. *Engineering Structures*, 260, 114241. <https://doi.org/10.1016/j.engstruct.2022.114241>

CONFERENCE PROCEEDINGS

- [C1] **Dutta, S.**, Wang, D., & Patiballa, S. K. Inverse design framework for fabric-based soft inflatable actuators. Accepted in *ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC) 2026*
- [C2] Conzola, J., **Dutta, S.**, Mahendran, A.N., Patiballa, S. K., & Vikas, V. Need for Speed: Gait-Agnostic Tendon-Routing Optimization for Terrestrial Tendon-Actuated Soft Robots. Accepted in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2026*

- [C3] **Dutta, S.**, & Patiballa, S. K. (2025). Towards Self-Sensing in Auxetic Metamaterials Using Displacement Mapping Framework. Volume 5: 21st IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications (MESA); 49th Mechanisms and Robotics Conference (MR). <https://doi.org/10.1115/DETC2025-169766>
- [C4] **Dutta, S.**, & Patiballa, S. K. (2023). Design optimization framework for uniform stress distribution of mechanical Metamaterials. Volume 4: Advanced Materials: Design, Processing, Characterization and Applications; Advances in Aerospace Technology. <https://doi.org/10.1115/imece2023-112793>
- [C5] Menon H.G., **Dutta S.**, Hariprasad M.P., Shankar B. (2021). Investigation on deflection characteristics of auxetic beam structures using FEM. Recent Advances in Manufacturing, Automation, Design and Energy Technologies, 621-628. https://doi.org/10.1007/978-981-16-4222-7_70
- [C6] **Dutta, S.**, Menon, H. G., Hariprasad, M., Krishnan, A., Shankar, B. (2021). Study of auxetic beams under bending: A finite element approach. Materials Today: Proceedings, 46, 9782-9787. <https://doi.org/10.1016/j.matpr.2020.10.479>

PATENTS

- [P1] **Dutta, S.**, MP, H., Shankar, B., Menon, H. G. (2025). Auxetic Member for Load Bearing Structures. IN. Patent No. 575791. Patent Office, Government of India. (Status: Granted, Filed in 2021)
- [P2] Shankar, B., MP, H., **Dutta, S.**, Menon, H. G. (2024). Auxetic Member for Load Bearing Structures. U.S. Patent No. 11981111. U.S. Patent and Trademark Office. (Status: Granted, Filed in 2021) <https://patents.google.com/patent/US11981111B2/en>

CONFERENCE PRESENTATIONS

1. ASME 2025 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC-CIE) *Anaheim, California* [Aug. 17-20, 2025]
2. Embodied Intelligence Conference (EI) 2025 by Bio-Inspired Robotics Laboratory, University of Cambridge, *Held in Cambridge U.K., Attended virtually* [Apr. 02-04, 2025]
3. ASME 2024 Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS), *Atlanta, Georgia* [Sep. 9-11, 2024]
4. ASME 2023 International Mechanical Engineering Congress & Exposition (IMECE), *New Orleans, Louisiana* [Oct. 29, 2023-Nov. 2, 2023]
5. ASME 2022 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC-CIE), *St. Louis, Missouri* [Aug. 14-17, 2022]
6. International Conference on Future Technologies in Manufacturing, Automation, Design & Energy, *National Institute of Technology Puducherry* [Dec. 28-30, 2020]
7. International Mechanical Engineering Congress 2019, *National Institute of Technology Tiruchirappalli* [Nov. 29, 2019-Dec. 1, 2019]

TEACHING EXPERIENCE

ME 489 & 490 - Mechanical Engineering Design I & II

Graduate Teaching Assistant, Department of Mechanical Engineering, UA

Aug. 2025-May 2026

- Mentoring 50+ senior engineering students through capstone design projects, evaluating technical feasibility, innovation, and presentation quality.

ME 372 - Dynamic Systems

Graduate Teaching Assistant, Department of Mechanical Engineering, UA *Aug. 2024-May. 2025*

- Developed supplementary MATLAB tutorials for dynamic systems modeling, improving student performance by providing hands-on computational skills training.
- Evaluated 70+ assignments per term and provided detailed feedback to individual students.

ME 349 - Engineering Analysis

Graduate Teaching Assistant, Department of Mechanical Engineering, UA *Aug. 2023-Aug. 2024*

- Graded 100+ assignments per term and provided detailed feedback to individual students.

ME 215 - Thermodynamics I

Graduate Teaching Assistant, Department of Mechanical Engineering, UA *Jun. 2023-Jul. 2023*

- Evaluated over 50 assignments per term, including homework, exams, and final assessments.

MENTORING EXPERIENCE

Heater Pattern Performance in R212 Soft Actuators *2025–2026*

- Mentored an Alabama School of Fine Arts senior on fabrication and experimental characterization of inflatable soft actuators; authored the ASME DETC paper and assisted with the school presentation poster.

Pneumatic Network Actuators with Varying Cavity Geometry *2023–2024*

- Mentored an Alabama School of Fine Arts senior on design, fabrication, and experimental benchmarking of pneumatic network actuators across varying cavity geometries; provided partial guidance on the technical report.

FELLOWSHIP AND AWARDS

Graduate Council Conference and Research Fund *2025*

UA Graduate School and Department of Mechanical Engineering for ASME IDETC 2025.

Graduate Council Conference and Research Fund *2024*

UA Graduate School and Department of Mechanical Engineering for ASME SMASIS 2024.

Graduate Council Conference and Research Fund *2023*

UA Graduate School and Department of Mechanical Engineering for ASME IMECE 2023.

Graduate Council Fellowship *2022–2023*

Awarded by the UA Graduate School; merit-based fellowship for incoming doctoral students.

SKILLS

- **Computational Tools:** Commercial FEA (ABAQUS), MATLAB (Numerical methods, local and global optimization), Python (NumPy, SciPy, Matplotlib, CMA-ES, OpenCV), CAD (Solidworks, Autodesk Fusion), Unity/VR-based design
- **Fabrication & Experimental Techniques:** 3D printing (FDM, SLA), Silicone casting and soft lithography, Digital Image Correlation (DIC), ASTM standard material testing
- **Visualization & Post-Processing:** Inkscape, Origin, Paraview, Adobe Creative Cloud
- **Languages:** English, Hindi, Marathi (Professional); Bengali (Native); Malayalam (Basic)