

Samarjith Biswas

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SUMMARY

As a doctoral candidate in Mechanical & Aerospace Engineering, I specialize in the domains of acoustic and thermoacoustic metamaterials. Collaborating with NASA's Langley Research Center, I've been at the forefront of designing and optimizing Thermoacoustic Metastructures (TAMS), pushing the boundaries of noise reduction and energy harvesting. Beyond research, I've embraced the role of educator, shaping young minds at OSU by instructing courses, guiding them through hands-on engineering projects, and leading discussions that promote critical thinking. With prior hands-on experience and a mastery over an array of technical tools, I consistently merge theoretical prowess with real-world application. Recognized for my contributions to engineering and academia, I'm poised to both advance my research and inspire future engineers.

EDUCATION

Doctor of Philosophy in Mechanical & Aerospace Engineering

Oklahoma State University | Stillwater, Oklahoma

Expected: 2024

Master of Science in Mechanical Engineering

Northern Arizona University | Flagstaff, Arizona

2019

Bachelor of Science in Mechanical Engineering

Rajshahi University of Engineering & Technology | Bangladesh

2016

RESEARCH EXPERIENCE

Graduate Research Associate

August 2019 – Present

Oklahoma State University | Stillwater, Oklahoma

- Developed Thermoacoustic Metastructure (TAMS) to harvest energy and mitigate noise, achieving a 5.28 dB reduction.
- Achieved a peak voltage of 33 mV with an output power of 19.8 μ W using an acoustic-thermoelectric transduction scheme.
- Led simulation-based studies to predict TAMS performance, informing design iterations and optimization strategies.
- Introduced modular TAMS designs for scalable noise barriers with energy capture.
- Optimized parameters for acoustic absorption vs. thermal gradients, enhancing multifunctional applications.
- Investigated friction impacts in mechanical metamaterials, focusing on structure-resonator interactions.
- Evaluated additive vs. traditional ceramic stacks, identifying cost-effective performance enhancements.
- Collaborated with experts from various fields, sharing findings in both internal meetings and external conferences.

Graduate Research Assistant

August 2017 - July 2019

Northern Arizona University | Flagstaff, Arizona

- Led the development and optimization of structural supercapacitors (SSCs) aiming to integrate power storage.
- Optimized SSC components, achieving a power density of 32.06 W/Kg and energy density of 53.58 mWh/kg at 2V.
- Improved electrode functionalization techniques, yielding a specific capacitance of 57.82 mF/g with operating voltage of 2.4V
- Collaborated with interdisciplinary teams to innovate energy-efficient materials and fabrication methods.

TEACHING EXPERIENCE

Instructor - Summer Bridge Program

July 2023

Oklahoma State University | Stillwater, Oklahoma

- Instructed two sections (30-40 students each) in the Summer Bridge Program, aiding their university transition.
- Led engineering design and fabrication projects, empowering students to apply theoretical knowledge in practical scenarios.
- Designed and implemented a curriculum tailored to address common challenges faced by incoming students.

Instructor of Record

January 2023 - May 2023

Oklahoma State University | Stillwater, Oklahoma

- Served as primary instructor of a 4000-level Machine Elements course within the MET department.
- Developed and revised course syllabi and materials, ensuring alignment with the latest industry practices.
- Provided individualized support, graded assignments and exams, and held regular office hours for student consultations.
- Collaborated with departmental faculty to continuously improve course content.

Graduate Teaching Associate

August 2019 – December 2022

Oklahoma State University | Stillwater, Oklahoma

- Taught Elementary Dynamics in two discussion sections with 25-30 students each, employing interactive methods.
- Independently led Honors discussions, promoting critical thinking and advanced problem-solving.
- Designed and supervised honors projects, enhancing student understanding and promoting collaboration.
- Hosted weekly office hours, addressing individual student queries and providing additional academic support.

TEACHING EXPERIENCE (Cont.)

Graduate Teaching Assistant

August 2017 - July 2019

Northern Arizona University | Flagstaff, Arizona

- Instructed advanced thermodynamics projects across four lab sections, enhancing students' grasp of key concepts.
 - Oversaw equipment usage in the Thermo-fluids lab and Machine shop and timely procurement of essential supplies.
 - Assisted in the design and implementation of lab experiments that bridged the gap between theory and practical applications.
 - Collaborated with professors on updating the thermodynamics curriculum to ensure alignment with current industry trends.
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PROFESSIONAL EXPERIENCE

Engineer (R&D)

December 2016 - July 2017

B-Trac Engineering Ltd | Dhaka, Bangladesh

- Led key projects including the design of a mobile watch tower, supervised and mentored a team of technicians and professionals.
 - Determined the most economical and practical electrical installation layout while ensuring high productivity in assigned tasks.
 - Collaborated closely with cross-functional teams to streamline R&D processes, leading to enhanced product quality.
 - Championed data-driven decision-making by analyzing performance metrics and feedback, resulting in a 15% improvement in project efficiency and execution.
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SKILLS

- **Areas of Expertise:** Engineering Acoustics, Failure analysis, Metallurgy, Manufacturing processes, Automatic control, Stress analysis, Statics and dynamics, Shock and vibration, Energy harvesting, Design of Experiments
 - **Equipment Knowledge:** Anechoic Test Chamber, NI-DAQ, CNCs, Mills, Lathes
 - **Software Skills:** AutoCAD, SolidWorks, ANSYS, LabVIEW, DeltaEC, FEA, CFD, CAM, MATLAB, Python, C, C++
 - **Soft Skills:** Project management, Teamwork, Cross-functional collaboration
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SELECTED PROJECTS

Parametric Characterization of a Thermoacoustic Liner

2023

- Collaborated with NASA on thermoacoustic device optimization using additive manufacturing. Employed NIT tube tests and DeltaEC simulations, achieving a 9.5°C peak gradient at 790 Hz. Explored critical parameters to enhance acoustic absorption and thermal output, setting groundwork for multifunctional applications.

Modeling Dispersion and Energy Harvesting in a Vibro-Thermal Metamaterial

2023

- Engaged in a groundbreaking study with global teams to examine friction's influence in mechanical metamaterials. Applied a nonlinear perturbation method to refine the dispersion relation, unveiling the energy harvesting capabilities through the Seebeck effect. Validated findings with time-based simulations, highlighting friction as a pivotal factor in frequency modulation. The study paves the way for innovative energy conversion applications using vibro-thermal metamaterials.

Feasibility of a Thermoacoustic Metastructure for Energy Harvesting and Noise Mitigation

2022

- Dove into the potential of thermoacoustics for simultaneous energy harvesting and noise abatement. Evaluated the performance of diverse ceramic and polymeric stack designs, utilizing the DeltaEC tool for simulations. Recorded a notable sound pressure dip of 5.28 dB at a resonance frequency of 117.5 Hz. The study culminated in the generation of a steady-state peak voltage of 33 mV, emphasizing the versatility and promise of thermoacoustic devices in urban settings.

Strategic Analysis of Thermoacoustic Metastructure Components

2022

- Led a comprehensive numerical analysis targeting lightweight and compact thermoacoustic metastructures. Delineated critical parameters such as stack length, position, and pore dimensions. Further, the study encompassed the fine-tuning of resonator configurations, emphasizing the significance of face sheet designs, chamber structures, and boundary conditions. The research aimed to maximize efficiency and adaptability across diverse thermoacoustic applications.

Evaluation of Additively Manufactured Stacks for Thermoacoustic Devices

2021

- Conducted an in-depth evaluation contrasting the efficacy of additively manufactured stacks against traditional ceramic ones. Utilized DeltaEC simulations to draw insightful performance correlations, aiming to determine the most viable stack for thermoacoustic applications.

Structural Power Storage Composite with Planar & Non-Planar Form Factor

2019

- Engaged in the design and evaluation of Structural Supercapacitors (SSCs) with an emphasis on additively manufactured stacks. Aimed at achieving a harmonized balance between energy storage and structural integrity for potential electric vehicle applications. Our findings showcased a promising energy density of 53.58 mWh/kg and a flexural modulus of 6.9 GPa, emphasizing the potential of SSCs in revolutionizing electromechanical systems.

SELECTED PROJECTS (Cont.)

- Mobile Watchtower Initiative for Bangladesh Police** 2017
- Directed the creation of a state-of-the-art mobile watchtower, amplifying police oversight capabilities. This strategic move elevated security protocols, providing dynamic surveillance flexibility and fortified law enforcement presence.
- Micro-Displacement Sensor for Surface Analysis** 2017
- Led an endeavor to revolutionize surface roughness analysis. The use of the Linear Variable Differential Transformer (LVDT) combined with advanced microelectronics enabled rapid, cost-efficient, and precise surface measurements. This method proved pivotal for both industrial applications and academic research, streamlining processes and setting new standards in measurement techniques.
- Optimization of Truss Structures via Finite Element Analysis (FEA)** 2016
- Undertook a comprehensive project to redefine truss design principles using Finite Element Analysis (FEA). By segmenting complex designs into simpler geometric shapes, the project significantly minimized design costs and time. The research further delved into various optimization avenues, focusing on topological, size, and geometric considerations. The culmination of the study highlighted a reduction in stress, displacement, and weight-driven costs for truss structures.
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AWARDS & SCHOLARSHIPS

- Best Oral Presentation, 4th Annual MAE Graduate Research Symposium** | Stillwater, Oklahoma 2022
- Title: "Quiet Power: Harnessing Energy from Noise via Thermoacoustics." Showcased the potential of mechanically robust harvesters to convert environmental noise into energy, ideal for powering sensors in remote locations, from oil pipelines to space probes.
- International Excellence Award, NAU** | Flagstaff, Arizona 2017 – 2019
- Granted for outstanding academic achievements and notable contributions to the international student community at NAU.
- Academic and Technical Scholarship from Rajshahi University of Engineering & Technology** | Bangladesh 2011 - 2016
- Consistently awarded for academic excellence throughout undergraduate studies, reflecting strong technical acumen.
- Academic Scholarship from VASI e. V. Preußendamm** | Berlin Lichterfelde, Germany 2011- 2013
- Received a scholarship from a German institution for global academic excellence and potential in international collaboration.
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LEADERSHIP & PROFESSIONAL INVOLVEMENT

- Judge, 5th Annual MAE Graduate Research Symposium** | Stillwater, Oklahoma 2023
- Evaluated graduate-level and advanced undergraduate research presentations at an event hosted by the School of Mechanical and Aerospace Engineering, offering constructive feedback for skill enhancement and knowledge sharing.
- Judge, Oklahoma State Science and Engineering Fair** | Stillwater, Oklahoma 2022 & 2023
- Collaborated with OSU to judge research projects from senior high students across diverse scientific disciplines, nurturing the next wave of STEM enthusiasts.
- Judge, 27th Annual OK-LSAMP Research Symposium** | Stillwater, Oklahoma 2022
- Played a pivotal role in assessing STEM research presentations by students from underrepresented backgrounds across 12 Oklahoma institutions, championing diversity in STEM.
- Lab Manager, Solid & Structural Dynamics Lab, OSU** | Stillwater, Oklahoma 2020-2023
- Managed daily operations, including meticulous database maintenance and upholding safety protocols. Orchestrated visits from industry collaborators, fostered inter-institutional partnerships, trained new members, and oversaw procurement of essential lab materials.
- OK Catalyst Roadmap, Spring Cohort** | Oklahoma City, Oklahoma 2022
- Engaged in an intensive technology commercialization boot camp, acquiring skills to transform research into market-ready solutions. Through collaborative workshops, I also honed my skills in crafting the Business Model Canvas and delivering a persuasive elevator pitch, positioning myself as a researcher primed to extend the reach and influence of academic discoveries into the entrepreneurial realm.
- Student A/V Room Monitor, ASA 182nd Meeting** | Denver, Colorado 2022
- Managed A/V logistics during sessions, liaised with session chairs, and expanded my professional network within the acoustics community.
- Vice President, Bangladesh Student Association, OSU** | Stillwater, Oklahoma 2019-2021
- Drove community outreach initiatives and deepened student engagement through diverse programs. Masterminded cultural events, successfully elevating and promoting the richness of Bangladeshi heritage within the OSU community. Additionally, established collaborative partnerships with other student organizations, fostering a harmonious intercultural exchange.

Peer Reviewer for Technical Manuscripts

- Assessed and provided feedback on manuscripts centered around acoustics and thermoacoustics, aiding in the elevation of research standards in the field.

PUBLICATIONS

- Biswas, S., & Manimala, J. M. (2022). Exploring the Feasibility of a Thermoacoustic Metastructure for Energy Harvesting and Noise Mitigation, in Proceedings of Meetings on Acoustics.
- Biswas, S., & Manimala, J. M. (2022). Quiet power: Exploring the feasibility of a noise-mitigating, thermoacoustic energy harvester, The Journal of the Acoustical Society of America.
- Biswas, S., Krawczyk, Z., & Manimala, J. M. (2021). Evaluation of additively manufactured stacks for thermo-acoustic devices, in INTER-NOISE and NOISE-CON Congress and Conference Proceedings.
- Nasreen, S., Rokunuzzaman, M., & Biswas, S. (2017). Assessment of Surface Roughness Using LVDT: A Convenient and Inexpensive Way of Measuring Surface Irregularities, in International Conference on Mechanical, Industrial and Materials Engineering.

Publications Under Review

- Biswas, S., Kresl, W., Manimala, J. M., Nark, D., & Jones, M. G. Parametric Characterization of a Thermoacoustic Liner.
- Biswas, S., & Manimala, J. M. Development of a Multifunctional Thermoacoustic Meta-Structure.

PRESENTATIONS

- The 50th International Congress and Exposition on Noise Control Engineering | Washington, D.C **August 2021**
- 182nd Meeting of the Acoustical Society of America | Denver, Colorado **May 2022**
- 40th ASME/AIAA regional symposium | Stillwater, Oklahoma **March 2021**

CERTIFICATIONS

Six Sigma Green Belt | Coursera- Kennesaw State University **June 2023**

- Completed four advanced courses in Six Sigma, including Six Sigma and the Organization, Six Sigma Advanced Define and Measure Phases, Six Sigma Advanced Analyze Phase, and Six Sigma Advanced Improve and Control Phases. Developed proficiency in proven principles and tools specific to Six Sigma and Lean methodologies.

Engineering Project Management Specialization | Coursera- Rice University **June 2023**

- Completed three advanced courses Engineering Project Management. Acquired skills in planning, scheduling, Earned Value Management (EVM), project management, and procurement.

COURSEWORK

Courses completed on edX: **August 2014 - July 2016**

- Underactuated Robotics - MIT, USA
- Solar Energy - TU Delft, Netherlands
- Autonomous Navigation for Flying Robots - TUM, Germany
- Robot Mechanics and Control - SNU, South Korea
- Street Fighting Mathematics - MIT, USA
- Cyber-Physical Systems - UC Berkeley, USA
- Future Cities - ETH Zurich, Switzerland
- Technology for Bio-based Products - TU Delft, Netherlands
- Age of Globalization - UT Austin, USA
- Ideas of the 20th Century - UT Austin, USA
- Learning from Data - CIT, USA

PROFESSIONAL MEMBERSHIP

Acoustical Society of America (ASA) **August 2021 -Present**
Student Member

- Engaged with other students and professionals in the field of mechanical engineering, participated in various events and activities organized by ASA, and contributed to the advancement of mechanical engineering through research and academic pursuits.

LANGUAGE PROFICIENCY

- English (Fluent), Bengali (Native language), Hindi (Working Knowledge)

REFERENCES

- References available upon request.