Muhammad Hasnain

Ph.D. Candidate | Department of Mechanical Engineering
Texas A&M University, College Station, TX 77840
ORCID: 0009-0004-6871-9713
Email: mhasnain5924117@tamu.edu

Homepage
Google Scholar
ResearchGate
LinkedIn

RESEARCH INTERESTS: Scientific Machine Learning, Multiphysics Modeling and Simulations, Computational Fluid Dynamics, Energy Systems, Graph Neural Networks, Transport in Reactive Porous Media

EDUCATION

Texas A&M University—College Station, Texas, United States 77840
Department of Mechanical Engineering
Doctor of Philosophy in Mechanical Engineering || GPA: 4.0/4.0 Anticipated May 2027

Dissertation Title (Anticipated): *Development of Generalizable Graph-based Deep Learning Models for Geometry-Aware Fluid Flow and Heat Transfer Applications*

Committee: N. K. Anand, PhD; Arun Srinivasa, PhD; Shuiwang Ji, PhD; Dorrin Jarrahbashi, PhD

Coursework: Introduction to Finite Element Method, Computer Aided Engineering, Fluid Mechanics, Numerical Partial Differential Equations, Gas Dynamics, Modeling and Analysis of Mechanical Systems, Finite Volume Techniques for Heat Transfer and Fluid Flow, Fundamentals of Turbulence Processes

Georgia Southern University—Statesboro, Georgia, United States 30458
Allen E. Paulson College of Engineering and Information Technology
Master of Science in Mechanical Engineering || GPA: 4.0/4.0 Jul 2024

Thesis Title: *Mathematical Modeling of Coupled Heat and Mass Transfer in Metal-Hydride Hydrogen Storage Systems (https://digitalcommons.georgiasouthern.edu/etd/2802/)*

Committee: Hayri Sezer, PhD; David Calamas, PhD; Hossain Ahmed, PhD; Jerry Hunter Mason, PhD

Coursework: Advanced Modeling and Simulation, Analysis of Energy Systems, Intro to FEA, Additive Manufacturing, Mechatronics I, Heat & Mass Transfer in Porous Media

Ghulam Ishaq Khan Institute of Engineering Sciences and Technology—Pakistan 23640
Bachelor of Science in Mechanical Engineering || GPA: 3.73/4.00 May 2021

George Mason University—Arlington, Virginia, United States 22201
Continuing and Professional Education
6.6 Continuing Education Units Jun 2020
Awarded for participating in the US Department of State's "Global UGRAD-Pakistan Program's Leadership, Engagement, and Action for Pakistan (LEAP) Institute".

Western Carolina University—Cullowhee, North Carolina, United States 28723
College of Engineering and Technology
Global UGRAD Exchange Program (Sponsored by US Department of State) || GPA: 4.0/4.0 May 2020

RESEARCH EXPERIENCE

Computational Heat Transfer Laboratory, Texas A&M University—College Station, Texas
Graduate Research Assistant (Department of Mechanical Engineering) Aug 2024 – Present

- Developed a novel graph neural network (GNN) architecture for modeling coupled heat transfer and fluid flow phenomena, integrating scientific machine learning workflows with OpenFOAM simulations to improve predictive efficiency and parametric extrapolation capabilities.
- Applied supervised and semi-supervised GNN frameworks to learn spatiotemporal dynamics of transient advection–diffusion systems, enhancing autoregressive forecasting and stability in time-series predictions.
- Contributed to the development of a convolutional neural network (CNN)-based surrogate modeling framework for adaptive time-stepping in transient high-speed flow simulations, enabling scalable and near real-time prediction through a two-stage deep learning methodology.
- Developing neural operator and graph neural operator architectures for PDE learning, investigating operator-based representations that generalize across varying geometries, boundary conditions, and physical parameter spaces.
- Developing hybrid physics-informed and geometry-aware learning frameworks that incorporate physics-regularized loss functions and domain-specific inductive biases to improve geometric and parametric generalization in computational fluid dynamics applications.
- Designed a novel solver-free data generation framework based on the Method of Manufactured Solutions (MMS), enabling the rapid generation of high-fidelity training datasets for both linear and nonlinear partial differential equations without reliance on conventional numerical solvers.
- Established a generalized MMS-driven scientific machine learning pipeline for PDE learning, providing analytically controlled datasets for training, validation, and benchmarking of neural operators and graph-based surrogate models across diverse governing equations.

Fire and Energy (FireGY) Lab, Georgia Southern University—Statesboro, Georgia
Graduate Research Assistant (Department of Mechanical Engineering) Aug 2022 – Jul 2024

- Conducted advanced research on coupled heat and mass transfer in reactive porous media using in-house Finite Volume codes in MATLAB, with applications in energy conversion, storage, and fire safety.
- Developed in-house finite-volume models in MATLAB for lithium-ion battery thermal runaway, coupling heat transfer with heat-induced decomposition kinetics to predict onset of runaway and heat release.
- Validated the decomposition-kinetics model against experimental data and benchmark models from the literature at subcritical and supercritical temperatures.
- Modeled thermal-runaway propagation in prismatic cells, quantifying how internal heat generation, cell-to-cell heat transfer, and pack configuration govern onset and spread of runaway (ASME IMECE 2023).
- Developed the first 3D model of gypsum-board dehydration under fire exposure and validated it against experimental thermogravimetric (TGA) data (*International Journal of Thermal Sciences,* 2026).
- Modeled coupled heat and mass transfer in metal-hydride hydrogen storage reactors, analyzing the effects of operating pressure, cooling configuration, and reactor geometry on heat dissipation (*Int. J. Hydrogen Energy,* 2024*; Renew. Sustain. Energy Rev.,* 2025).
- Contributed concept development, mathematical modeling, and proposal writing to an NIJ-funded project ($290,289) combining computation and experiments for dehydration of gypsum board under fire exposure.
- Mentored graduate and undergraduate researchers in computational modeling, numerical simulation, technical writing, and research methodology.

TEACHING TRAINING AND EXPERIENCE

Center for Teaching Excellence, Texas A&M University—College Station, Texas
Academy for Future Faculty Fellow (In Progress) Expected May 2027

- A year-long professional development program focusing on evidence-based teaching practices, course design, and higher education pedagogy.
- Developing a comprehensive teaching portfolio, including a statement of teaching philosophy, sample syllabus, and course design blueprint.
- Engaging in peer teaching evaluations, active learning strategy workshops, and inclusive classroom instruction training.

Department of Mechanical Engineering, Texas A&M University—College Station, Texas
Graduate Teaching Assistant — Aug 2024 – Dec 2024

- MEEN 344 — Fluid Mechanics (90+ students)
- Delivered lectures in the professor's absence and held office hours to assist with course contents.
- Managed grading for all assignments and examinations, ensuring consistent communication and feedback from students.

Center for Teaching Excellence, Texas A&M University—College Station, Texas
Teaching Assistant Institute (TAI) — Aug 2024

- Completed the **Teaching Assistant Institute**, an intensive pedagogical training hosted by the Center for Teaching Excellence.
- **Key Skills:** Classroom management, inclusive instructional strategies, and academic integrity protocols for recitation leaders, laboratory instructors, and lecturers.

Department of Mechanical Engineering, Georgia Southern University—Statesboro, Georgia
Graduate Teaching Assistant and Lab Instructor — Aug 2023 – May 2024

- **Responsibilities**
  - Provided individualized academic support and guidance (during office hours) related to course materials, problem-solving, and engineering software tools.
  - Graded homework assignments, quizzes, exams, and lab reports with detailed technical feedback.
  - Assisted students with experimental procedures, numerical methods, and engineering design concepts.
  - Proctored examinations and supported course logistics and assessment activities.
  - Mentored students in technical report writing, data analysis, and interpretation of results.

Course	Role / Scope of Support
MENG 7136 — Mechatronics I Lab	Supervised and instructed graduate laboratory sessions involving sensors, actuators, and instrumentation systems; assisted students with experimental setup, data acquisition, and system integration for mechatronic applications.
MENG 4210 — Energy Science Laboratory	Assisted with laboratory instruction reinforcing concepts from fluid mechanics, thermodynamics, and heat transfer; guided students in data analysis and technical report preparation.
ENGR 2139 — Numerical Methods in Engineering	Supported instruction in computational techniques for engineering analysis, including numerical solutions of linear systems, regression, and error analysis; assisted with MATLAB-based numerical implementations and problem-solving.
ENGR 2112 — Solid Modeling and Analysis	Assisted students in developing CAD models using SolidWorks, including assemblies, surface modeling, and basic structural and flow simulations; provided guidance on design for manufacturing and additive manufacturing concepts.

Orbit Coaching Academy—Pakistan
Instructor, Pre-Engineering Summer Coaching Program — Jun 2022 – Aug 2022

- Taught pre-engineering courses for ETEA engineering entrance examination preparation, preparing students for competitive admission to top engineering universities in Pakistan.

RESEARCH PUBLICATIONS

Peer-Reviewed Articles		Conference Proceedings	
Published	Under Review	Published	Under Review
8	3	10	2

Citation Statistics[1]		
Citations	h-index	Research Interest Score
92+	4	97.7

Research Interest Score: 97.7, ranking **higher than 96% of ResearchGate researchers who began publishing in 2023** [1].

[1]ResearchGate Link, Google Scholar

Peer-Reviewed Articles

- **Muhammad Hasnain**, Hayri Sezer, Shijin P. Kozhumal. 2026. "Predicting Thermal Response of Gypsum Board Under Various Heat Flux Configurations: A Three-Dimensional Mathematical Model." *International Journal of Thermal Sciences*. https://doi.org/10.1016/j.ijthermalsci.2025.110457.
- M. Usman Khan, **Muhammad Hasnain**, Hayri Sezer, Shijin Kozhumal, Muthu K. Selvaraj, Albert Simeoni. 2026. "Predictive Heat Transfer Model for Fire-Induced Injuries in Tree Stem." *International Communications in Heat and Mass Transfer*. Volume 180, Part 3, 112653, ISSN 0735-1933 https://doi.org/10.1016/j.icheatmasstransfer.2026.112653.
- Jacob Helwig, Sai Sreeharsha Adavi, Xuan Zhang, Yuchao Lin, Felix S. Chim, Luke Takeshi Vizzini, Haiyang Yu, **Muhammad Hasnain**, Saykat Kumar Biswas, John J. Holloway, Narendra Singh, N. K. Anand, Swagnik Guhathakurta, Shuiwang Ji, 2026. "A Two-Phase Deep Learning Framework for Adaptive Time-Stepping in High-Speed Flow Modeling." *The Fourteenth International Conference on Learning Representations* (*ICLR 2026*). https://openreview.net/forum?id=d4gzLgGl7I
- **Muhammad Hasnain**, N. K. Anand, Arun Srinivasa, Pratyush Kumar, 2025. "A Novel Residual Multilayer Perceptron-based Graph Convolutional Network for Modeling Heat Transfer and Fluid Flow." *Physics of Fluids.* Volume 37, 107138. https://doi.org/10.1063/5.0292956.
- **Muhammad Hasnain**, Hayri Sezer, Jerry Hunter Mason, 2025. "Mathematical Modeling of Heat and Mass Transfer in Metal Hydride Hydrogen Storage Systems: A Comprehensive Review." *Renewable and Sustainable Energy Reviews* Volume 226, Part B, 116294. https://doi.org/10.1016/j.rser.2025.116294.
- **Muhammad Hasnain**, Hayri Sezer, Jerry Hunter Mason, 2024. "Modeling Heat and Mass Transfer in Metal Hydride Hydrogen Storage Systems: Impact of Operating Parameters and Reactor Geometry." *International Journal of Hydrogen Energy* 71 (June):1045–55. https://doi.org/10.1016/j.ijhydene.2024.05.311.
- **Muhammad Hasnain**, Shehzad Khan, M.Amin Ezazi, Hayri Sezer, " Modeling Heat and Mass Transfer in Metal Hydride-Based Hydrogen Storage Systems Using the Finite Volume Method." Proceedings of the ASME 2023 International Mechanical Engineering Congress and Exposition. Volume 10: Heat Transfer and Thermal Engineering. New Orleans, Louisiana, USA. October 29–November 2, 2023. V010T11A047. ASME. https://doi.org/10.1115/IMECE2023-112874.
- Shehzad Khan, Sohail Anwar, Jairo Casa, **Muhammad Hasnain**, Hossain Ahmed, Hayri Sezer, "Modeling Thermal Runaway in Prismatic Lithium-Ion Batteries." *Proceedings of the ASME 2023 International Mechanical Engineering Congress and Exposition*. Volume 10: Heat Transfer and Thermal Engineering. New Orleans, Louisiana, USA. October 29–November 2, 2023. V010T11A048. ASME. https://doi.org/10.1115/IMECE2023-113787.

Under Review Papers

- **Muhammad Hasnain**, N. K. Anand, Arun Srinivasa, 2026. "MIGONet: a Multiple-input Graph Neural Operator with Solver-free Discrete Manufactured-solution Training." Under Review in *Transport Phenomena.*
- **Muhammad Hasnain**, N. K. Anand, Pratyush Kumar, Arun Srinivasa, Shuiwang Ji, 2026. "A Physics-Regularized Graph Neural Surrogate for Parametric and Geometric Extrapolation in Backward-Facing Step Flow." Under Review in *Physics of Fluids.* Available at SSRN: http://dx.doi.org/10.2139/ssrn.6446623.
- **Muhammad Hasnain**, Hayri Sezer, Jerry Hunter Mason. 2025. "Modeling heat and mass transfer in metal hydride hydrogen storage reactors: Impact of operating conditions, and reactor size on hydrogen desorption." Under Review in the *International Journal of Hydrogen Energy*, Preprint available at SSRN: https://ssrn.com/abstract=4898120.

CONFERENCE PROCEEDINGS AND INVITED TALKS

Non-Peer Reviewed Conference Proceedings

- **Muhammad Hasnain,** N. K. Anand, P. Kumar, A. Srinivasa, S. Ji. July 2026. "A Physics-Assisted Geometry-Generalizable Graph Convolutional Network for Fluid Flow", *17th World Congress on Computational Mechanics (WCCM-2026) & 10th European Congress on Computational Methods in Applied Sciences and Engineering*. Computational Fluid Dynamics (CFD) and Fluid-Structure Interaction (CFSI): Methods Development and Applications. Munich, Germany.
- **Muhammad Hasnain**, et al., "Application of Graph Neural Networks (GNNs) for Heat Transfer and Fluid Flow Problems", ASME 2025 *International Mechanical Engineering Congress and Exposition* (IMECE2025). Machine Learning and Quantum Computing for Fluids. Memphis, Tennessee, USA.
- Shehzad Khan, **Muhammad Hasnain**, et al., "Mathematical Modeling of Heat-Induced Decomposition Kinetics Leading to Thermal Runaway in Lithium-ion Batteries", 2*024 Spring Technical Meeting of the Eastern States Section of The Combustion Institute*, Athens, Georgia, USA.
- **Muhammad Hasnain**, Rylan Paye, Trevor Borth, Gregory E. Gorbett, Shijin P. Kozhumal, Hayri Sezer, "Three-Dimensional Mathematical Modeling of Heat and Mass Transfer during Calcination of Gypsum Board Exposed to Fire", *2024 Spring Technical Meeting of the Eastern States Section of The Combustion Institute*, Athens, Georgia, USA (March 2024).
- S. Khan, **Muhammad Hasnain**, J. Casa, A. Said, V. Akkerman, M. Selvaraj, A. Simeoni, H. Sezer, "Mathematical Modeling of Heat-Induced Decomposition Kinetics Leading to Thermal Runaway in Lithium-ion Batteries", *2024 Spring Technical Meeting of the Eastern States Section of The Combustion Institute*, Athens, Georgia, USA (March 2024).
- A. Idris, S. Khan, **Muhammad Hasnain**, M. Selvaraj, A. Simeoni, H. Sezer, "Numerical Modeling of Spontaneous Ignition in Large Coal Stockpiles using Finite Volume Method", *2024 Spring Technical Meeting of the Eastern States Section of The Combustion Institute*, Athens, Georgia, USA (March 2024).
- M. Usman, **Muhammad Hasnain**, S. Khan, A. Simeoni, R. Ziazi, H. Sezer, "Mathematical Model for Predicting Injuries and Temperature Distributions in Stem Exposed to Fire", *2024 Spring Technical Meeting of the Eastern States Section of The Combustion Institute*, Athens, Georgia, USA (March 2024).
- **Muhammad Hasnain**, Rylan Paye, Jairo Casa, Trevor Borth, Gregory E. Gorbett, Shijin P. Kozhumal, Hayri Sezer, "3D Mathematical Model for Heat and Mass Transfer Mechanisms in Gypsum Board Exposed to Fire", *13th US National Combustion Meeting*, College Station, Texas, USA, March-2023.
- Shehzad Khan, **Muhammad Hasnain**, Abdullah Liaqat, Vyacheslav Akkerman, Hossain Ahmed, Shijin P. Kozhumal, Hayri Sezer, "The self-heating ignition of lithium-ion batteries: a comparative study of COMSOL and GPYRO models with finite volume toolbox", *13th US National Combustion Meeting*, College Station, Texas, USA, March-2023.

Poster Presentations

- **M. Hasnain**, H. Sezer, "Mathematical Modeling of Heat and Mass Transfer in Metal-Hydrides for Safer and More Efficient Hydrogen Storage Reactors",9th Annual Texas A&M Conference on Energy, Engineering, Science & Policy Pathways to a Resilient Energy Future. September-2025.
- **M. Hasnain**, et al., "Three-Dimensional Multiphysics Modeling of Heat and Mass Transfer during Calcination of Gypsum Board for Forensic Fire Investigations", Student Research Symposium, Georgia Southern University, April-2024.
- **M. Hasnain**, et al., "Mathematical Modeling of Coupled Heat and Mass Transport in Metal-Hydrides for Safer and More Efficient Hydrogen Storage Systems", Student Research Symposium, Georgia Southern University, April-2024.
- **M. Hasnain**, et al. "Solving Transient Advection-Diffusion Equations: Using PINNs and Finite Volume Method" Student Research Symposium, Georgia Southern University, April-2024
- P.D. Castillo, S. Khan, **M. Hasnain**, H. Sezer, "An Immersed Boundary Method for Drag Coefficient Calculations in Complex Rigid and Flexible Vegetation", Student Research Symposium, Georgia Southern University, April-2024.
- J. Kruger, S. Khan, **M. Hasnain**, H. Sezer, "Simulation of Two Pool Fires Converging using FDS and Applications with Wildfires", Student Research Symposium, Georgia Southern University, April-2024.

- **M. Hasnain**, et al., "A Diffusion-based Mathematical Modeling of Hyperbaric Oxygen Therapy for Chronic Wounds", Student Research Symposium, Georgia Southern University, April-2023.
- S. Khan, **M. Hasnain**, et al., "Mathematical Modeling of Thermal Runaway in Lithium-Ion Batteries", Student Research Symposium, Georgia Southern University, April-2023.
- **M. Hasnain**, et al., "Modeling and Optimization of Metal Hydride Based Hydrogen Storage Systems", Student Research Symposium, Georgia Southern University, April-2023
- S. Khan, **M. Hasnain**, H. Sezer, "A Mathematical Model for Thermal Metamaterials", Student Research Symposium, Georgia Southern University, April-2023.

Invited Talks

RAISE AI Bridge Summit, Texas A&M University Jan 5–9, 2026
- Delivered a Use-Inspired Spotlight presentation on the application of Graph Neural Networks (GNNs) to CFD problems, presenting domain challenges, and AI-driven modeling opportunities.

Research Excellence Series: Roadmap to Publication, Undergraduate Research Organization (UROG), Ghulam Ishaq Khan Institute (GIKI), Pakistan Apr 19, 2026
- Invited to deliver a workshop on **methodology development and experimental design** as part of a structured research training program for undergraduates.
- Presented best practices in designing reproducible experiments, structuring research workflows, and transitioning from problem identification to implementation.
- Mentored participants on aligning research design with publication standards.

GRANT & PROPOSAL WRITING

National Institute of Justice (NIJ) — U.S. Department of Justice **Funded (2023)**

Proposal Title: *Experimental and Numerical Investigations for the Development and Validation of Thermo-chemistry Models and Property Databases for Selected Wall Lining Materials under Fire Exposure*

Total Funding: $290,289 (Award on NIJ Website)

Contributions: Concept development, mathematical modeling, and proposal writing.

Resulting Publications:

(1) **M. Hasnain**, H. Sezer, & S. P. Kozhumal. (2026). Predicting thermal response of gypsum board under various heat flux Configurations: A three-dimensional mathematical model. *International Journal of Thermal Sciences*, *221*, 110457. Available on NIJ Website.

(2) **M. Hasnain**, et al., "3D Mathematical Model for Heat and Mass Transfer Mechanisms in Gypsum Board Exposed to Fire", 13th US National Combustion Meeting, College Station, Texas, USA, 2023. Available on NIJ Website.

U.S. Department of Energy — Consolidated Innovative Nuclear Research Program **Under Review (2026)**

Proposal Title: *A Geometry-Generalizable Framework for Optimizing Rod Bundles Using Graph Neural Networks*

Requested Funding: $1,100,000

Principal Investigator: N. K. Anand, **Co-PIs:** Arun Srinivasa and Shuiwang Ji, Texas A&M University

Collaborators: Mauricio T. Retamales (Idaho National Laboratory), Hangbok Choi (General Atomics)

Contributions: Concept development, methodology formulation, and proposal writing.

U.S. Department of Energy — Consolidated Innovative Nuclear Research Program **Under Review (2026)**

Proposal Title: *A Novel Efficient Large Eddy Simulation (ELES) Framework*

Requested Funding: $500,000

Principal Investigator: N. K. Anand, **Co-PI:** Shuiwang Ji, Texas A&M University

Contributions: Literature review, conceptual development, and proposal writing.

National Aeronautics and Space Administration (NASA) **Submitted (2024)**

Proposal Title: *Advancing the In-Space Welding and Additive Manufacturing Process through Multiphysics and Multiscale Computational Models*

Requested Funding: $589,556
Principal Investigator: Hayri Sezer, Georgia Southern University
Contributions: Proposal draft preparation and conceptualization.

PROFESSIONAL DEVELOPMENT & RESEARCH TRAININGS

RAISE AI Bridge Summit, Texas A&M University Jan 5–9, 2026

- Participated in a week-long (40+ hours) interdisciplinary AI research summit organized under the RAISE initiative to catalyze use-inspired AI research and collaborations.
- Completed advanced tutorials covering supervised and unsupervised learning, large language models, vision and vision-language models, reinforcement learning, physics-informed machine learning, Bayesian learning, and uncertainty quantification.

Summer PACES Research Training Workshop, Albuquerque, NM Aug 11–15, 2025

- Selected participant for an intensive training on high-performance computing (HPC), AI/ML workflows, and data-driven scientific computing.
- Gained hands-on experience with Linux-based HPC systems, Python/Jupyter workflows, and machine learning methods for large-scale computational research on NSF-supported computing clusters.

OpenFOAM Advanced CFD Training Certifications — OpenFOAM / CFD Direct Jan-Feb 2025

- Completed four professional certifications in OpenFOAM and computational fluid dynamics (CFD), covering OpenFOAM architecture, Linux-based workflows, finite-volume methods, turbulence modeling, multiphase flows, conjugate heat transfer, dynamic meshing, numerical solvers, and parallel high-performance computing workflows.
- **Courses completed**: OpenFOAM Foundation Course, OpenFOAM Advanced Course, Essential CFD with OpenFOAM, and Applied CFD with OpenFOAM.

Machine Learning Specialization — University of Washington via Coursera 2021

- Completed a four-course specialization covering core machine learning concepts and applications, including machine learning foundations, regression modeling, classification algorithms, and clustering & retrieval techniques.
- The program emphasized practical implementation using Python for data analysis, predictive modeling, and machine learning workflows.

Python for Data Science and Machine Learning, various platforms 2021–2023

- Training in Python-based data science and machine learning workflows including predictive modeling, data analysis, and applied deep learning.
- Courses include:
  - Machine Learning, Data Science and Deep Learning with Python (Udemy)
  - Build 10 Real-World Applications with Python (Mega Programming Course)
  - Data Science and Machine Learning Training, Digital Skills for KP Initiative

MATLAB Master Class 2020 — IETE Mumbai and Pantech Prolabs India Pvt. Ltd. 2020

- Completed an intensive technical workshop on advanced MATLAB programming and scientific computing.
- The tutorials focused on data analysis, algorithm development, and simulation techniques commonly used in engineering and applied research.

HONORS, AWARDS, AND DISTINCTIONS

Research & Scholarly Awards

- **Graduate Student Research and Presentation (RAP) Travel Award** ($1000), Graduate and Professional School, Texas A&M University, College Station, Texas. Summer 2026.

- **Graduate Student Child Care (CC) Travel Award** ($750), Graduate and Professional School, Texas A&M University, College Station, Texas. Summer 2026.
- **Top Eagle Award & Best Graduate Student Award** ($500), **Georgia Center of Innovation**, Research Symposium, Georgia Southern University — "Three-Dimensional Multiphysics Modeling of Heat and Mass Transfer during Calcination of Gypsum Board for Forensic Fire Investigations", April 2024. (1st POSITION in the Graduate research category among 176 total posters).
- **2nd PLACE Innovation Award** ($350), **Georgia Power**, Student Research Symposium, Georgia Southern University— "Mathematical Modeling of Coupled Heat and Mass Transport in Metal-Hydrides for Safer and More Efficient Hydrogen Storage Systems", April-2024.
- **Graduate Student Organization (GSO) Research Award** ($750), Georgia Southern University— Recognized for outstanding research contributions as a graduate student, Fall 2023.
- **2nd Place Research Award** ($350), **Southern Automation Logistics & Technology**, Research Symposium, Georgia Southern University — "Diffusion-based Mathematical Modeling of Hyperbaric Oxygen Therapy for Chronic Wounds", April 2023.
- **3rd Place Research Award** ($250), **Gulfstream Aerospace**, Student Research Symposium, Georgia Southern University — "Mathematical Modeling of Thermal Runaway in Lithium-Ion Batteries", April 2023.
- **3rd Place Research Award** ($250), **Southern Automation Logistics & Technology**, Research Symposium, Georgia Southern University — "Modeling and Optimization of Metal Hydride Based Hydrogen Storage Systems", April 2023.

Scholarships & Competitive Programs

- **Global UGRAD Program Scholar**, U.S. Department of State — Fully funded international academic exchange at Western Carolina University representing Pakistan, 2020.
- **KP Chief Minister Merit Scholarship**, awarded for outstanding academic performance during undergraduate studies at GIK Institute, 2017-2021.
- **Certified Mechanical Engineer**, Pakistan Engineering Council — National professional engineering licensure, 2021.

Academic Distinctions

- **Dean's Honor Roll**, GIK Institute — Awarded for academic distinction in **all semesters of undergraduate studies (8 consecutive semesters)**, 2017–2021.

- **7th Position,** ETEA Engineering Entrance Examination (national competitive exam), Pakistan, 2017. Awarded PKR 80,000 in merit prizes from Orbit Coaching Academy and Quaid-e-Azam Group of Schools & Colleges.

INDUSTRY AND APPLIED ENGINEERING EXPERIENCE

E.R. Snell Contractor, Inc.—Snellville, Georgia
Engineering Intern — May 2023 – Jul 2023

- Analyzed industrial asphalt manufacturing workflows including material heating, mixing, and transport processes, gaining exposure to large-scale thermal processing systems and quality control procedures.
- Observed laboratory characterization and quality assurance testing of asphalt materials used in infrastructure projects, providing insight into materials performance evaluation and engineering standards.
- Completed OSHA 10-hour Construction Safety and Health certification, gaining training in industrial safety protocols and engineering risk management practices.

CureMD—Lahore, Pakistan
Artificial Intelligence Research Intern — Aug 2021 – Feb 2022

- Developed a convolutional neural network (CNN) in TensorFlow (Python) for multimodal sentiment classification from speech and text data following speaker diarization, implementing supervised learning pipelines for feature extraction and model evaluation.

- Implemented algorithmic problem-solving projects in C#, including automated solvers for combinatorial puzzles, strengthening computational thinking and software development practices relevant to scientific computing workflows.
- Completed technical training in mathematical modeling, machine learning methods, and algorithmic problem solving for data-driven applications.

PepsiCo—Pakistan
Logistics and Supply Chain Intern (Pakistan's largest project-based internship) Jun 2021 – Jul 2021
- Conducted benchmarking analysis of health, safety, and environmental (HSE) standards in logistics operations across multinational food manufacturing companies.
- Contributed to process evaluation and operational efficiency assessment within large-scale distribution networks.

Zigron (Pvt.) Limited—Pakistan
Technology and Communications Intern Sep 2020 – Nov 2020
- Conducted technical research on emerging smart-home security technologies including IoT-based monitoring and automation systems.
- Produced technical reports and documentation evaluating technology trends and deployment strategies in residential security solutions.

Gadoon Textile Mills Limited—Pakistan
Mechanical Engineering Intern Jul 2019 – Aug 2019
- Studied automated textile manufacturing processes and machinery used in high-throughput yarn production systems, including mechanical drive systems and process automation.
- Developed CNC part-programming exercises using G-code and M-code (ISO-6983) to support computer-aided manufacturing workflows in industrial machine tools.

PROFESSIONAL AND COMMUNITY SERVICE

Journal Peer Reviewer
- ***International Journal of Hydrogen Energy*** — 9 reviews (2024–2026)
- ***Physics of Fluids*** — 4 reviews (2025–2026)
- ***ASME Journal of Thermal Science and Engineering Applications*** — 3 reviews (2025–2026)
- ***International Journal of Thermal Sciences*** (2026)
- ***Computers and Fluids*** (2026)

Professional Memberships
- Member, American Society of Mechanical Engineers (ASME) since 2023
- Member, The Combustion Institute since 2023
- Member, Texas A&M Energy Research Society since 2024

Community Engagement, Mentorship, and Student Support

Volunteer – Texas Science & Engineering Fair (TXSEF)
Spark! PK-12 Engineering Education Outreach, Texas A&M Engineering Mar 2026
- Supported STEM outreach event by facilitating operations at a statewide K-12 science and engineering fair.
- Provided guidance and information to diverse participants including students, educators, and judges.
- Assisted in logistical coordination, contributing to the effective execution of the event.

Research Mentor, Fire and Energy (FireGY) Laboratory, Georgia Southern University 2022–2024
- Mentored graduate and undergraduate students in computational modeling, numerical simulations, and research methodology in energy and fire safety applications.

Student Mentor, Mentor Collective at Georgia Southern University 2023-2024

- Guided new university students during academic and social transition, providing mentorship on academic planning, research opportunities, and campus engagement.

Community Volunteer, Community Table — Sylva, North Carolina, USA Spring 2020

- Completed 20 hours of community service as part of the Global Undergraduate Exchange Program. Assisted with meal preparation, food service, and kitchen operations supporting local community members.

Member, Project Topi — GIK Institute of Engineering Sciences and Technology 2017–2021

- Participated in community welfare initiatives including anti-child-labor awareness, educational support for underprivileged children, food and grocery distribution to financially struggling families during the COVID-19 pandemic, and organizing large-scale blood donation drives in collaboration with Pakistan Red Crescent Society.

TECHNICAL SKILLS AND EXPERTISE

- **Scientific Machine Learning:** Graph Neural Networks, Physics Informed Neural Networks, Pytorch, Tensorflow, PyG (PyTorch Geometric), JULIA SciML
- **Simulation and Modeling / CFD tools:** OpenFOAM, MATLAB, ANSYS (Structural, and Thermo-Fluids), Fusion360, SolidWorks, CREO
- **Computational Methods:** Finite Volume Methods, Numerical Modeling, Lattice Boltzmann Method (LBM), CFD and Turbulence Modeling
- **Programming Languages:** MATLAB, Python, JULIA, C++
- **Experimental Techniques:** Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Particle Imaging Velocimetry (PIV)