

MD SHAFIKUL ISLAM

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RESEARCH INTERESTS & VISION

Enabling Cyber-Physical Intelligence in Additive Manufacturing by Combining Learning, Modeling, and Uncertainty Reasoning to Move from Passive Monitoring to Reliable Active Control and Scalable Quality Assurance.

EDUCATION

- [E2] Dept. of Mechanical & Industrial Eng, Louisiana State University (LSU)** Jan. 2025 – Present
Ph.D. Student Baton Rouge, LA, USA
- *LSU GPA: 4.03* (18 credit academic courses and 6 research credits)
 - *Research Focus:* Trustworthy and Transferable Autonomy for Cyber-Physical Systems, Geometry-Invariant Melt Pool Control, Physics-Informed GenAI for Self-Healing Manufacturing.
 - *Key Projects:* Physics-Informed Machine Learning for Process Defect Detection and Fatigue Modeling in WAAM-Fabricated Complex Concentrated Alloys; Building "ArcAssist," a multimodal edge AI co-pilot for Wire Arc Additive Manufacturing.
- [E1] Dept. of Industrial & Production Engineering, Shahjalal University (SUST)** Jan. 2019 – Mar. 2024
Bachelor of Science Sylhet, Bangladesh
- Undergraduate Thesis Advisor: [Dr. Abul Mukid Mohammad Mukaddes](#)
 - *Overall GPA: 3.74/4.00*; Class Rank: Top 5% among 60 students
 - Undergraduate Thesis: *Predict Students' Performance and Optimize Preparatory Leave: An Integrated Deep Learning and Dynamic Programming Approach.*
 - SUST Research Center Project: *Development of an Automated Timetabling Software Using Genetic Algorithm.*

RESEARCH EXPERIENCE

- [R3] AnalyticsIQ Lab: Intelligent Sensing and Analytics for System Informatics, LSU** Jan. 2025 – Present
Graduate Research Assistant Baton Rouge, LA, USA
- Project:** *Physics-Informed Machine Learning for Process Defect Detection and Fatigue Modeling in WAAM-Fabricated Complex Concentrated Alloys (Funded by NSF-LAMDA)*
- Co-authored the successful grant proposal; managed material procurement and experimental setup.
 - Engineering a sensor-integrated Wire Arc Additive Manufacturing (WAAM) platform by synchronizing IR thermal imaging, optical emission, and electrical sensors to capture layer-wise melt pool dynamics.
 - Developing a Physics-Informed CNN (PI-CNN) to fuse multi-modal in-situ data for real-time porosity detection, utilizing XCT scans for ground-truth validation.
 - Formulating a Physics-Guided LSTM fatigue model that links process-induced defects to structural performance, integrating fracture mechanics with deep learning.
- Project:** *DrinkSafe LA: Place-Based Environmental Literacy for Safe and Resilient Fresh Water (Funded by the National Academies Gulf Research Program & NOAA)*
- Collaborated on the implementation of data-driven algorithms to analyze environmental water quality metrics for resilience modeling.
 - Optimized and debugged Python-based data processing pipelines to ensure accurate analysis of local freshwater system data.
- [R2] Dept. of Industrial & Production Engineering, Shahjalal University (SUST)** Jun. 2022 – Dec. 2022
Undergraduate Researcher Sylhet, Bangladesh
- Project:** *Development of an Automated Timetabling Software Using Genetic Algorithm*
- Developed an automated scheduling system using Genetic Algorithms, managing data processing pipelines to optimize constraint satisfaction and algorithm performance.

[R1] Computational Intelligence and Operations Lab (CIOL) ([Link](#))

Founder & Director

Jan. 2022 – Present

Sylhet, Bangladesh

Project: *Graph Neural Networks and Decision-Focused Learning for Supply Chain Optimization*

- Developed "SupplyGraph," a benchmark GNN framework for multi-echelon supply chain planning, improving connectivity prediction and robustness analysis.
- Proposed a decision-focused learning approach for Inventory Routing Problems, utilizing neural networks to optimize complex logistical decisions under uncertainty.

PUBLICATIONS

PEER REVIEWED JOURNAL PAPERS

- [J8]** Islam, M. S., Anik, M. A., Wasi, A. T., Bappy, M. M., "Fracture Finder: Computer-Aided Real-Time Diagnosis of Vertebral Fractures in Thoracic Spine X-Rays Using YOLOv8 with Weighted Box Fusion and Augmentation Strategies", *IJSE Transactions on Healthcare Systems Engineering*, 2026, doi: 10.1080/24725579.2025.2598578 [Link](#)
- [J7]** De La Hoz, J. L. M., Bappy, M. M., Islam, M. S., Marcantel, M., Hayes, M. P., "AI-Enabled Modeling for Smart Rural Wastewater Treatment Systems: Current Practices and Remaining Gaps", *Applied Water Science*, 2026, doi: 10.1007/s13201-025-02698-6. [Link](#)
- [J6]** Shakibaei, H., Islam, M. S., Bappy, M. M., "A Fuzzy Data-Driven Framework for Enhanced Risk Management Decision-Making in Manufacturing: A Case Study", *Manufacturing Letters*, 2025, doi: 10.1016/j.mfglet.2025.06.187. [Link](#)
- [J5]** Biswas, S., Al Mamun, A., Islam, M. S., Bappy, M. M., "Interpretable CNN models for Computationally Efficient Bearing Fault Diagnosis Using Learnable Gaussian/Sinc Filters", *Manufacturing Letters*, 2025, doi: 10.1016/j.mfglet.2025.06.015. [Link](#)
- [J4]** Ahsan, M. N., Islam, M. S., Bappy, M. M., "Generative Modeling in Smart Manufacturing: Applications, Challenges, and Future Directions", *Manufacturing Letters*, 2025, doi: 10.1016/j.mfglet.2025.06.148. [Link](#)
- [J3]** De La Hoz, J. L. M., Bappy, M. M., Islam, M. S., Marcantel, M., Hayes, M. P., "Interpretable Forecasting of Dissolved Oxygen Leveraging Foundation Model for Proactive Aeration in Rural Wastewater Treatment Systems", *Water Research*, 2025, doi: 10.1016/j.watres.2025.124931. [Link](#)
- [J2]** Islam, M. S., Tushar, S. R., Bappy, M. M., Ali, M., Al Nadim, A., "Evaluating Challenges to the Adoption of Smart Textiles in Readymade Garment Industries: Implications for Sustainable Business Development", *Green Technologies and Sustainability*, 2025, doi:10.1016/j.grets.2025.100225. [Link](#)
- [J1]** Pan, D., Al Mamun, A., Zhou, R., Bappy, M. M., Islam, M. S., "Comprehensive and Comparative Characterizations of Tensile Properties and Fracture Mechanisms of 3D Printed Multifunctional Carbon-Fiber and Metal-Filled PLA Composite Parts", *Polymer Composites*, doi: 10.1002/pc.70281. [Link](#)

REFEREED CONFERENCE & WORKSHOP PAPERS

- [C10]** Alshehri, A. S., Wasi, A. T., Anik, M. A., Islam, M. S., Hadj-Kali, M. K., "Virtual Node-Augmented Diffusion Recurrent Networks for Spatiotemporal Supply Chain Forecasting", *2025 8th International Conference on Algorithms, Computing and Artificial Intelligence (ACAI)*, [Conference Website](#)
- [C9]** Islam, M. S., Bappy, M. M., "Privacy-Aware Porosity Prediction in Metal Additive Manufacturing using Hierarchical Graph Attention Networks", *INFORMS Annual Meeting*, 2025. [Presentation](#)
- [C8]** Islam, M. S., Bappy, M. M., "Inference-Driven Strategy Design for Professional Societies: A Hybrid Machine Learning and Scenario Simulation Framework", *INFORMS Annual Meeting*, 2025. [Presentation](#)
- [C7]** Islam, M. S., Bappy, A. M. A., Wasi, A. T., Mohammad, M., "FRACTURE FINDER: Vertebral Fracture Localization for Spine X-Ray Analysis", *IJSE Annual Conference and Expo*, 2025. [Presentation](#)
- [C6]** Islam, M. S., Bappy, M. M., "Explainable Vision Transformer-Based Real-Time Anomaly Detection for Fused Deposition Modeling", *IJSE Annual Conference and Expo*, 2025. [Presentation](#)
- [C5]** Islam, M. S., Bappy, M. M., "Foundation Model-Driven Predictive and Interpretable Modeling for Critical Materials in Renewable Energy Applications", *Proceedings of the 99th Annual Meeting of the Louisiana Academy of Sciences (LAS)*, 2025. [Presentation](#)
- [C4]** Islam, M. S., Mukaddes, A. M. M., Uddin, M., "Predict Students' Performance and Optimize Preparatory Leave: An Integrated Deep Learning and Dynamic Programming Approach", *27th International Conference on Computer and Information Technology (ICCIT)*, 2024. [Full Paper](#)
- [C3]** Wasi, A. T., Islam, M. S., Akib, A. R., "SupplyGraph: A Benchmark Dataset for Supply Chain Planning using Graph Neural Networks", *Graphs and more Complex structures for Learning and Reasoning workshop, AAAI 2024*. [Full Paper](#)

- [C2] **Islam, M. S.**, Wasi, A. T., "Optimizing Inventory Routing: A Decision-Focused Learning Approach using Neural Networks", *New in Machine Learning Workshop, NeurIPS 2023*. [Short Paper](#)
- [C1] **Islam, M. S.**, Wasi, A. T., "Multivariate Time Series Analysis and Forecasting on Air Quality Index with Industrial Statistics: A Case Study of Bangladesh", *7th International Conference on Engineering Research, Innovation and Education (ICERIE)*, 2023.

PREPRINTS / WORKING PAPERS (arXiv / SSRN)

- [P4] Wasi, A. T., Anik, M. A., Rahman, A., Hoque, M. I., **Islam, M. S.**, Ahsan, M. M., "A Theoretical Framework for Graph-based Digital Twins for Supply Chain Management and Optimization", *arXiv preprint*, 2025. [arXiv:2504.03692](#)
- [P3] Wasi, A. T., **Islam, M. S.**, Akib, A. R., Bappy, M. M., "Graph Neural Networks in Supply Chain Analytics and Optimization: Concepts, Perspectives, Dataset and Benchmarks", *arXiv preprint*, 2024. [arXiv:2411.08550](#)
- [P2] Anik, M. A., Rahman, A., Hoque, M. I., Wasi, A. T., **Islam, M. S.**, Ahsan, M. M., "Biotwinmine: Digital Twin-Based Optimization of Biomining for Sustainable Rare Earth Element Production", *SSRN Working Paper*, 2025. [SSRN: 5258720](#)
- [P1] **Islam, M. S.**, Bappy, M. M., De La Hoz, D., Martinez, J. L., Chowdhury, S., "Foundation Model-Driven Predictive and Interpretable Modeling for Critical Materials in Renewable Energy Applications", *SSRN Working Paper*, 2025. [SSRN: 5248814](#)

POSTER PRESENTATIONS

- [PS1] Anik, M., Hoque, I., **Islam, M. S.**, Wasi, A. T., Bappy, M. M., Ahsan, M. M., "Sustainable Management of Rare Earth Elements for Clean Energy Using Prescriptive Digital Twins", *Digital Twin for Manufacturing Sustainability, Safety, and Resilience*, Purdue University, 2024.

OPEN SCIENCE & RESEARCH ARTIFACTS

- [OS2] **Computational Intelligence and Operations Lab (CIOL) — Open Resources (Founder & Director)** Jan. 2022 – Present
Built and maintained an open research/learning ecosystem at the intersection of Optimization and Machine Learning, supporting reproducible code, tutorials, and research dissemination. [Website](#) · [YouTube](#)
- [OS1] **SupplyGraph — Open-Source Benchmark for Supply Chain Planning with GNNs** 2024
Open repository for dataset generation, baselines, and reproducible experiments used in the AAAI Workshop paper. [GitHub](#)

PROFESSIONAL MEMBERSHIPS

- [M1] **Institute of Industrial and Systems Engineers (IISE)** 2025 – 2026

MEDIA & PRESS

- [P2] **IIE Innovative Design Competition (2025) — Winner Highlight** ([Winner](#))
- [P1] **LSU Mechanical & Industrial Engineering reposted award-winning update** ([LinkedIn](#))
- [P0] **INFORMS Data Mining Society posted Stakeholder Data Challenge results** ([LinkedIn](#))

TEACHING & MENTORING

- [T1] **Instructor & Mentor, CIOL Winter ML Bootcamp** Jan. 2024
Delivered sessions on Explainable AI and Translating Code to Research; mentored a cohort of ~20 students and maintained reusable learning materials ([Materials](#)).

ACADEMIC ACHIEVEMENTS AND AWARDS

- [A9] **Champion, IIE Innovative Design Competition**, IIE Annual Conference & Expo, 2025
Recognized for the most innovative design solution project titled "Hearth AI - Meaningful Connection at your Fingertips".
- [A8] **Runner-up, Stakeholder Engagement Data Challenge**, INFORMS Annual Meeting, 2025
First Runner-up in analyzing large-scale stakeholder data to derive strategic insights for professional societies.

- [A6] 2nd Runner-up, QCRE Data Challenge**, IISE Annual Conference & Expo, 2025
Second Runner-up in the Quality Control and Reliability Engineering data competition.
- [A5] Best Graduate Oral Presentation**, Louisiana Academy of Sciences (99th Annual Meeting), 2025
Selected as the best oral presentation in the Materials Science and Engineering division.
- [A4] NSF Student Travel Award**, North American Manufacturing Research Conference (NAMRC), 2025
Competitive grant awarded by the National Science Foundation to support conference attendance.
- [A3] NSF Student Travel Award**, IISE Annual Conference & Expo, 2025
Competitive grant awarded by the National Science Foundation to support conference attendance.
- [A2] Best Technical Presentation**, IEEE Int. Conf. on Computer and Information Technology (ICCIT), 2024
Awarded for the best technical presentation in the session. (*Merit-based*)
- [A1] University Merit Scholarship**, Shahjalal University of Science and Technology, 2020–2024
Awarded for maintaining outstanding academic performance (Top 5% of class) for four consecutive years.

GRANT PROPOSAL WRITING

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| [G4] Physics-Informed ML for Process Defect Detection and Fatigue Modeling in WAAM
<i>National Science Foundation (NSF) LAMDA Seed Grant</i> | Aug. 2025
<i>Funded</i> |
| [G3] Cross-Modality Domain Adaptation for Anomaly Detection in LPBF Systems
<i>NASA EPSCoR Cooperative Agreement Notice (CAN)</i> | Aug. 2025
<i>Recommended</i> |
| [G2] Privacy-preserving Certification Framework for AMaaS Platforms
<i>NSF Southwest I-Corps IdeaLaunch Program (Role: Entrepreneurial Lead)</i> | Feb – Mar. 2025
<i>Selected</i> |
| [G1] Crowd-Sourced Data with ML for Road Condition Monitoring
<i>Louisiana Transportation Research Center (LTRC) TIRE Program</i> | Jan. 2025
<i>Not Funded</i> |

PROFESSIONAL SERVICE & INVITED TALKS

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| [S3] Invited talk, Center for Rotating Machinery Lab (CeRoM), LSU
<i>On Application of Machine Learning Methods in Grease Manufacturing under Data Scarcity</i> | Dec. 12, 2025
<i>Baton Rouge, LA, USA</i> |
| [S2] Reviewer , 2026 International Manufacturing Science and Engineering Conference (MSEC) | 2025 – Present |
| [S1] Session Chair , 2025 IISE Annual Conference & Expo | May 2025 |

TECHNICAL SKILLS

Programming	Python, MATLAB, C, Julia, SQL
Machine Learning	PyTorch, PyTorch Geometric, TensorFlow, Scikit-learn, PyCaret, DeepXDE, Hugging Face Transformers
Optimization	Gurobi, Pyomo, CVXPY, JuMP
Data Science	Pandas, NumPy, Matplotlib, Seaborn, Tableau, Jupyter
Software & Tools	LaTeX, Git, Docker, Microsoft Office, AutoCAD, Arena, SolidWorks
Languages	English (Fluent), Bengali (Native)

OUTREACH & COMMUNITY

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| [O1] Seminar Organizer, CIOL Research Community
Organized and delivered a higher-education research seminar attended by 50+ students (Video). | Nov. 2023 |
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LEADERSHIP

- [L1] Sports Secretary**, Bangladeshi Student Association (BSA), LSU Jun. 2025 – Present
Lead organizing committees for tournaments and community events; coordinate logistics, registrations, scheduling, and participation.