Tanvir Ahmed Shanto

Ph.D. in Mechanical Engineering

Experimental & Computational Solid Mechanics | Design of Experiment | Material Characterization | Process Innovation

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Research Profile

Mechanical Engineering Ph.D. with more than seven years of combined research and engineering experience in experimental and computational solid mechanics, fracture mechanics, statistical inference, and data-driven manufacturing. Doctoral research integrates factorial experimental design, infrared thermography, X-ray micro-computed tomography, quasi-static and viscoelastic testing, finite element analysis, and machine learning to quantify and validate process–structure–property relationships in additively manufactured polymers and polymer composites.

Education

Ph.D. in Mechanical Engineering **Sep 2021–Aug 2026**

The University of Texas at Arlington *Arlington, Texas, USA*

Dissertation: Improving Strength and Fracture Resistance in Fused Filament Fabrication Through Printhead-Integrated In-Situ Annealing.

Advisor: Dr. Robert M. Taylor

B.Sc. in Naval Architecture and Marine Engineering **Feb 2013–Sep 2017**

Bangladesh University of Engineering and Technology (BUET) *Dhaka, Bangladesh*

Thesis: Predicting crack propagation at vulnerable locations of ship structures and analyzing possible mitigation measures

Research Experience

Graduate Student Researcher **Aug 2021–Aug 2026**

The University of Texas at Arlington *Arlington, Texas, USA*

- Developed an experimentally anchored process–structure–property framework for thermally assisted FFF by integrating in-process MWIR thermography, X-ray μ-CT, tensile testing, dynamic mechanical analysis, Mode-I compact-tension testing, and SEM fractography to connect interfacial thermal history and void morphology with structural response.
- Designed and analyzed a randomized $2 \times 3 \times 5$ full-factorial experiment (60 print batches) using GLM/ANOVA, Type III sums of squares, interaction analysis, residual normality/variance/independence diagnostics, and Tukey HSD; identified a printhead–speed interaction and a sample-spacing effect on toughness.
- Demonstrated that controlled in-situ annealing increased ABS-CF ultimate tensile strength by 39%, elastic modulus by 30%, glassy storage modulus by 63%, and Mode-I interlaminar fracture resistance by approximately 92%. Representative μ-CT measurements showed crack-path void content decreasing from approximately 4.0% to 0.7%, accompanied by a shift from interfacial delamination toward cohesive fracture.
- Developed μ-informed RVE and cohesive-zone models in Abaqus for DCB and SENB specimens to estimate direction-dependent elastic properties, characterize interfacial traction–separation behavior, and compare simulated load–displacement response with experiments.
- Designed and prototyped adaptive in-situ annealing printhead hardware using GD&T and DFM/DFA principles, contributing to one issued and one pending U.S. patent and translating the work into peer-reviewed publications and commercialization activities.
- Executed ASTM-aligned tensile, compression, three-point-bending, fatigue, DMA, and fracture-testing campaigns; mentored students in test planning, instrumentation, data reduction, statistical interpretation, and technical writing.

Research and Technical Expertise

Computational mechanics	Abaqus, ANSYS, HyperWorks, HyperStudy, and CAESAR II; finite element analysis, multiphysics analysis, experimental-to-model comparison, RVE/micromechanics, and cohesive-zone methods.
Experimental mechanics	Tensile, compression, three-point-bending, fatigue, DMA, and Mode-I fracture testing.
NDE & characterization	MWIR/IR thermography; X-ray μ-CT; optical and SEM/EDS fractography; DSC, TGA, STA, FTIR, XRD, and AFM.
Statistics & UQ foundation	Full-factorial and fractional-factorial DoE; GLM/ANOVA.
Data science & ML	Python, MATLAB, SAS Studio, Fortran, and LLM few-shot benchmarking.
Design & manufacturing	SolidWorks, AutoCAD/Plant 3D, ASME Y14.5 GD&T, DFM/DFA; FFF, SLA, SLS, material jetting, DLP, multi-axis extrusion, DFAM, and LPBF; ASTM and ISO test methods.

Peer-Reviewed Journal Articles

1. **Shanto, T. A.**, Ahmed, R., Patel, P., Zulqernine, M. J., Chen, V., Jain, A., & Taylor, R. M. (2026). In-situ annealing and thermal-morphological evolution during extrusion-based additive manufacturing. *Journal of Manufacturing Processes, 170*, 303–318. doi:10.1016/j.jmapro.2026.05.005
2. Ahmed, R., Dola, I. S., Ahmed, S., Rahman, M. M., **Shanto, T. A.**, & Taylor, R. M. (2026). A review of design and fabrication strategies for thermoplastic lightweight thin-walled stiffened shells and lattice structures utilizing fused-filament fabrication (FFF). *International Journal of Advanced Manufacturing Technology*. doi:10.1007/s00170-026-18078-6
3. Patel, P., Ahmed, R., **Shanto, T. A.**, Jain, A., & Taylor, R. M. (2025). Experimental characterization of enhanced fused filament fabrication (FFF) of tall thin-walled structures using polylactic acid (PLA). *International Journal of Advanced Manufacturing Technology, 139*(11–12), 5663–5675. doi:10.1007/s00170-025-16171-w
4. Uddin, M. M., Akhtaruzzaman, R., **Shanto, T. A.**, & Hasan, M. N. (2023). Study the performance of a dynamic wall heat exchanger using computational fluid dynamics. *European Journal of Engineering and Technology Research, 8*(3), 38–42. doi:10.24018/ejeng.2023.8.3.3043
5. Patel, P., Rahman, M. M., **Shanto, T. A.**, Kulkerni, P., Ahmed, R., Jain, A., & Taylor, R. M. (2026). Evaluation of in process heating for extrusion printing of tall thin-walled structures. *Progress in Additive Manufacturing*. doi:10.1007/s40964-026-01852-z

Manuscripts Under Review

1. **Shanto, T. A.**, Rahman, M. M., Barua, S., Ahmed, S., Raiyan, A. Z., Ahmed, R., Jain, A., Adnan, A., & Taylor, R. M. In-situ annealing of vertically printed short-carbon-fiber ABS: A process–structure–property study of bonding potential, voids, and z-direction performance. Under Review at *Composites Part B: Engineering*.
2. **Shanto, T. A.**, Ahmed, R., Patel, P., Barua, S., Dola, I. S., Chen, V., Jain, A., & Taylor, R. M. Adaptive annealing in extrusion-based additive manufacturing and machine-learning-based prediction of mechanical performance. Under Review at *Additive Manufacturing*.
3. Ahmed, R., **Shanto, T. A.**, Ahmed, S., Raiyan, A. Z., Adnan, A., Jain, A., & Taylor, R. M. Process–structure–property relationships in FFF PLA parts. Under Review at *Progress in Additive Manufacturing*.

Works in Progress

1. **Shanto, T. A.**, Ahmed, S., Labanya, F. N., Lin, S., & Taylor, R. M. Characterizing and improving fracture behavior in 3D-printed polymers using Mode-I fracture testing. Manuscript under internal review.
2. Rahman, M. M., **Shanto, T. A.**, Ahmed, R., & Taylor, R. M. Improving the sealing capacity of FFF ducts for aerospace environmental-control-system applications. Manuscript in preparation.
3. Ahmed, S., **Shanto, T. A.**, Ahmed, R., & Taylor, R. M. Improving the mechanical performance of lightweight PLA for unmanned aerial vehicles. Ongoing research.
4. Ahmed, R., Zulqernine, M. J., **Shanto, T. A.**, Lin, S., & Taylor, R. M. Improving the compressive strength of thin-walled stiffened cylindrical structures and characterizing damage using acoustic-emission sensing. Ongoing research.

Peer-Reviewed Conference Publications

1. Dola, I. S., Ahmed, R., Zulqernine, M. J., **Shanto, T. A.**, & Taylor, R. M. (2026). Evaluation of deep learning architectures for defect detection in fused filament fabrication. *SAMPE Conference and Exhibition*. doi:10.33599/nasampe/s.26.91
2. Ahmed, S., Rahman, M. M., **Shanto, T. A.**, Ahmed, R., & Taylor, R. M. (2026). A statistical approach for evaluating printing-temperature effects on lightweight and generic polylactic acid in fused filament fabrication. *IISE Annual Conference Proceedings*. Link

3. Rahman, M. M., Ahmed, S., **Shanto, T. A.**, Ahmed, R., & Taylor, R. M. (2026). A statistical study on the influence of build-volume temperature and bead overlapping of PEI in fused filament fabrication. *IISE Annual Conference Proceedings*. Link
4. Ahmed, R., **Shanto, T. A.**, Rahman, M. M., Taylor, R. M., & Jain, A. (2025). Machine learning-based prediction of toughness in fused filament fabrication: Leveraging in-process annealing with enhanced printheads. In *Solid Freeform Fabrication 2025: Proceedings of the 36th Annual International Solid Freeform Fabrication Symposium – An Additive Manufacturing Conference*, 1182–1200. PDF
5. **Shanto, T. A.**, Pavel, H. R., Ahmed, R., Abdullah, M., & Taylor, R. M. (2025). Leveraging large language models for process parameter optimization in 3D-printed ABS polymer specimens. *IISE Annual Conference and Expo 2025, Conference Proceedings*, 1351–1356. doi:10.21872/2025IISE_6901
6. **Shanto, T. A.**, Shahriar, M. A., Ahmed, T., Zulqernine, M. J., & Taylor, R. M. (2025). Predicting mechanical strength in FDM-printed ABS parts with in-process annealing: A machine-learning approach. *IISE Annual Conference and Expo 2025, Conference Proceedings*, 1224–1229. doi:10.21872/2025IISE_6734
7. Abdullah, M., Ozay, D., Ahmed, S. M. T., **Shanto, T. A.**, & Sridhar, E. P. (2025). Genetic algorithms in order-picking route optimization: A review of advances and implications for logistics. *IISE Annual Conference and Expo 2025, Conference Proceedings*, 1375–1380. doi:10.21872/2025IISE_6932
8. Ahmed, R., Niloy, R. S., Mozumder, M. R., & **Shanto, T. A.** (2024). Application of fused filament fabrication in the marine sector: From rapid prototyping to final product. *Proceedings of MARTEC 2024*. PDF
9. Zulqernine, M. J., Alam, M. A., Uddin, M. R., Dola, I. S., & **Shanto, T. A.** (2024). An investigation on the applications of additive manufacturing in the marine industry. *Proceedings of MARTEC 2024*. PDF

Patents

1. Taylor, R. M., Rane, R., Mrinal, M., Patel, P. T., & **Shanto, T. A.** *Fused filament fabrication print-head system*. U.S. Patent 12,496,776 B2. Patent record
2. **Shanto, T. A.**, Taylor, R. M., Mrinal, M., Ahmed, R., Patel, P. T., Rahman, M. M., Dola, I. S., & Deshpande, R. *Fused filament fabrication adaptive annealing print-head system*. U.S. Patent Application No. 19/660,770.

Teaching and Mentoring Experience

Teaching Assistant **Sep 2021–Present**
The University of Texas at Arlington *Arlington, Texas, USA*

- **Additive Manufacturing (MAE 5329; 200+ students):** Conducted laboratory exercises in SLA, SLS, material jetting, and FFF; trained students on universal testing, Simplify3D, PolyWorks, 3-Matic, and FARO arm scanning; mentored senior-design teams through 3D-printed UAV design, fabrication, testing, and competition activities.
- **Solid Mechanics (MAE 2312; 30 students):** Led supplemental problem-solving sessions, supported coursework and projects, held office hours, and evaluated assignments, quizzes, and examinations.
- **Additional courses:** Problems in MAE (MAE 1140; 100 students), Introduction to Manufacturing (MAE 3344; 50 students), Thermodynamics I (MAE 3310; 40 students), and Engineering Analysis (MAE 5332; 48 students); supported instruction, assessment, office hours, and project guidance.
- Selected for the I-ENGAGE Student Mentorship Program to guide undergraduate researchers in technical concepts, research methods, and problem-solving.

Professional and Industrial Experience

Co-Founder and Technical Lead **Aug 2022–Present**
Increscent, Inc. *Texas, USA*

- Translated a university-developed extrusion-based 3D-printing method into a staged R&D and commercialization roadmap with measurable performance milestones and qualification criteria.
- Authored technical proposals and grant applications, including a successful $50,000 NSF I-Corps Team award and two SBIR Phase I proposals on AI-enabled extrusion-based additive manufacturing.
- Led structured customer discovery and translated voice-of-customer evidence into product requirements; prepared technical white papers, test reports, pitch decks, and partner/investor materials.

Mechanical Engineer **Oct 2018–Oct 2019**
Super Petrochemical Limited *Bangladesh*

- Designed process equipment and piping layouts in SolidWorks and AutoCAD Plant 3D, performed piping-stress analysis in CAESAR II, and supported proposal review for a $10M mooring and pipeline program.
- Coordinated a 70-person mechanical workshop and maintenance crew, prioritized work orders, allocated resources, and enforced safe, high-quality repairs using Lean Six Sigma practices.
- Reduced oil-tanker construction and maintenance costs by approximately 10% through process-waste identification, planning improvements, and vendor coordination.

Honors, Grants, and Awards

- **NSF I-Corps Team Award, $50,000:** High-Performance 3D-Printed Plastic Parts Through Novel Process Enhancement.
- **Maverick Business Pitch Competition, $35,000 venture award:** Recognized for technical innovation, commercialization strategy, and business presentation.
- **Wheelwright Foundation Scholarship, $2,000** (2023).
- **I-ENGAGE Student Mentorship Program, $2,000 stipend:** Selected to mentor undergraduate researchers.
- **Blackstone LaunchPad Campus Award, $1,000** (2022).

Professional Service and Membership

Reviewer, *Journal of Thermal Analysis and Calorimetry* (Springer Nature), 2026 — 1 manuscript.
Member, American Society of Mechanical Engineers (ASME).

Academic References

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