James Afful

MECHANICAL ENGINEERING RESEARCHER

Ames, IA | 515.567.9863 | jamezafful@gmail.com

Research Interests

Computational Fluid Dynamics (CFD) · High-Performance Computing (HPC) · Artificial Intelligence (AI)

Applications in Infrastructure Resilience · Clean Energy · Public Health · Agricultural Digital Twins

Education

Iowa State University - Ames, IA

Ph.D. in Mechanical Engineering (Computational Science), Expected 2026

Dissertation: High-Fidelity CFD and AI Frameworks for Infrastructure, Energy, and Public Health Systems

Kwame Nkrumah University of Science & Technology (KNUST) – Kumasi, Ghana

B.Sc. Mechanical Engineering, 2021

Dissertation: Design and construction of a solar-powered cocoa pod breaker and beans separator.

Honors & Selective Memberships

- Sigma Xi, The Scientific Research Honor Society (Full Member; peer-nominated, research-based induction)
- Pi Tau Sigma, International Mechanical Engineering Honor Society (Top 25% cohort selection)
- ASME VOLT Academy (Member-at-Large) – selective governance/leadership program, American Society of Mechanical Engineers
- American Physical Society (APS) – Active member in Fluid Dynamics/Computational Physics Divisions
- American Institute of Aeronautics and Astronautics (AIAA) – Active technical forums contributor
- U.S. Research Software Engineers Association (US-RSE) – National-level professional body for HPC/AI software leaders.

Professional Experience

Lawrence Livermore National Laboratory (LLNL) – Livermore, CA

Research Scholar, National Security Engineering Division – Summer 2024

- Developed high-fidelity CFD models for isotope-separation under ultra-high vacuum (AVLIS program).
- Research outputs integrated into national-interest evaluation workflows at LLNL.
- Recognized by senior staff for "original and impactful contributions."

Center for Building Energy Research (CBER), Iowa State University – Ames, IA

Graduate Research Assistant (NSF/DOE Projects) – 2022–Present

- Developed scalable CFD pipelines for K-12 school ventilation, informing Iowa Economic Development Authority's $199,878 state-funded study.
- Co-lead on AI-enabled environmental modeling frameworks (NSF INFEWS & AIIRA).
- Mentored and evaluated NSF REU students in federally funded research programs.

Engineers Without Borders (EWB) – ISU & KNUST Chapters

Vice President / Project Lead – 2018–2021

- Directed sustainable energy/water projects impacting rural communities.
- Managed technical design reviews, funding proposals, and student-faculty teams.

Peer Review & Judging Activities

- Committee Member, 2025 US-RSE Community Awards Program (national-level technical awards).
- Abstract Reviewer, IndabaX Ghana 2025 (AI/ML research conference, supported by DeepMind & Oxford).
- Short Paper Reviewer, PEARC 2025 (Workforce Development Track; NSF/DOE-backed HPC conference).
- Reviewer, International Journal of Mechanical Engineering and Applications (appointed, 2025–2028).
- Reviewer, Journal of Mechanical Engineering and Manufacturing (energy systems).
- Engineering Judge, State Science + Technology Fair of Iowa (ISEF affiliate).
- NSF REU Research Evaluator, Center for Building Energy Research, ISU

Original Contributions of Major Significance

- K-12 Ventilation Policy Impact – CFD models adopted into state-level guidelines (Iowa/DMPS) aligned to ASHRAE 241; supported $25M of school retrofits.
- National Security – LLNL isotope-separation modeling for U.S. defense/nuclear programs.
- AI for Agriculture – Developed NeRF-based plant geometry reconstruction pipeline (low-cost, field-deployable digital twins for crops).
- Urban Greening & Energy Models – Integrated CFD vegetation microclimate models into DOE's EnergyPlus to improve building energy simulations

Publications & Scholarly Authorship

Peer-Reviewed Journal Articles

- Muhammad Arbab Arshad, Talukder Jubery, James Afful, Anushrut Jignasu, Aditya Balu, Baskar Ganapathysubramanian, Soumik Sarkar, Adarsh Krishnamurthy. "Evaluating Neural Radiance Fields for 3D Plant Geometry Reconstruction in Field Conditions." Plant Phenomics, 2023. (Impact Factor 7.3; cited 25+ times)

Conference & Workshop Publications

- Anushrut Jignasu, Ethan Herron, Talukder Zaki Jubery, James Afful, Aditya Balu, Baskar Ganapathysubramanian, Soumik Sarkar, Adarsh Krishnamurthy. "Plant Geometry Reconstruction from Field Data using NeRFs." AAAI AI for Agriculture & Food Systems Workshop, 2023.

Preprints

- James Afful. "ExplainBench: A Benchmark Framework for Local Model Explanations in Fairness-Critical Applications." arXiv.
- James Afful. "A Review of HPC-Accelerated CFD in National Security and Defense." arXiv.

Manuscripts in Development

- High-Fidelity CFD Simulations for Evaluating Ventilation in K–12 Classrooms (Lead Author).
- CFD-EnergyPlus Coupled Algorithm for Urban Vegetation Microclimates (Co-Author).

Certifications (EB-1A Supporting Evidenc**Peer Review Excellence Certification – IOP Publishing**

- Reviewing in the Sciences – Web of Science Academy
- Quantum Computing Specializations – IBM (Cryptography, Variational Algorithms, Information Theory, Business Foundations)
- Deep Learning Fundamentals – NVIDIA
- Scientific Computing with Python – freeCodeCamp
- Finite Element & CFD Specializations – Coursera
- FAA-Certified Unmanned Aircraft Pilot
- Lean Six Sigma Green Belt – LinkedIn
- Project Management Essentials – Management & Strategy Institute

Leadership & Service

- President, Mechanical Engineering Graduate Student Organization (MEGSO), ISU
- Vice President (now Advisor), Emerging Leaders in Engineering, ISU
- STEM Mentor & Judge, State STEM fairs, NSF REU, and youth engineering competitions

Selected Presentations

- 18th U.S. National Congress on Computational Mechanics (USNCCM18) – CFD for K-12 Ventilation (invited presentation).
- AAAI 2023 – AI for Agriculture & Food Systems Workshop – NeRF-based digital twins for crops.
- International High Performance Computing Summer School – Kobe, Japan