Yang Gao

Lecturer, Mechanical Engineering, Ingram School of Engineering
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EDUCATION

Ph.D., Mechanical Engineering, North Carolina A&T State University, Greensboro, NC, USA
Graduation: May. 2023
Dissertation: *The Fluid Physics Capturing Capability of the Integro-Differential Scheme*
Committee: Dr. Frederick Ferguson, Dr. John P Kizito, Dr. Michael Atkinson, Dr. Mookesh Dhanasar

Master, Mechanical Engineering, North Carolina A&T State University, Greensboro, NC, USA
Graduation: May. 2019
Thesis: *Investigating the Integro-Differential Scheme Performance in Solving Euler Equations*
Committee: Dr. Frederick Ferguson, Dr. John P Kizito, Dr. Michael Atkinson, Dr. Mookesh Dhanasar

B.S., Mechanical Engineering, North Carolina A&T State University, Greensboro, NC, USA
Graduation: May. 2017

RESEARCH / PROJECT AREA

- Computational Fluid Dynamics (CFD)
- Renewable Ocean Energy
- Waverider Design
- Scramjet Design

APPOINTMENTS

Lecturer, Texas State University, San Marcos, TX	2026 - present
Research Associate, North Carolina A&T State University, Greensboro, NC	2024 - 2025
Adjunct Teaching Professor, North Carolina A&T State University, Greensboro, NC	2023 - 2025
Graduate Assistant, North Carolina A&T State University, Greensboro, NC	2019 - 2023

SPONSORED RESEARCH PROJECTS

1. Project Title: Rolling Element Geometry Effects in Tribolectric Nanogenerators: Finite Element Simulation, Undergraduate Design & Research Project – (Objective 3)
   Role: Senior Personnel
   Source of Support: DOE – North Carolina Renewable Ocean Energy Program (NCROEP)
   Total Award Amount: **$45,000**, Award Period: July 2025 – June 2026
2. Project Title: Improving the efficiency of a wave energy converter: Topology optimization and Multi-Scale experiments
   Role: Senior Personnel
   Source of Support: DOE – North Carolina Renewable Ocean Energy Program (NCROEP)
   Total Award Amount: **$75,000**, Award Period: July 2024 – June 2025
3. Project Title: Optimization of Ocean Wave Energy Converters
   Role: Senior Personnel
   Source of Support: DOE – North Carolina Renewable Ocean Energy Program (NCROEP)
   Total Award Amount: **$75,000**, Award Period: July 2023 – June 2024

PROJECT EXPERIENCE

Senior Personnel & Project Lead- Wave Energy Capstone Project – Senior Design Project *2024 – Present*
North Carolina A&T State University *Greensboro, NC*

- Led the development and optimization of small and large-scale Oscillating Water Column (OWC) prototypes for wave energy conversion.
- Integrated real-time data acquisition systems for RPM, torque, and power measurements.
- Employed Computational Fluid Dynamics (CFD) simulations and the WEC-Sim tool to analyze and enhance fluid dynamics and turbine performance.
- Mentored undergraduate and graduate students, fostering practical skills in experimental methodology and numerical analysis.
- Coordinated interdisciplinary collaboration, resulting in innovative turbine designs inspired by bio-inspired concepts such as the Piezoelectric Kelp Forest.
- Supervised curriculum development and facilitated industry partnerships to promote marine renewable energy education.

Faculty Mentor - Undergraduate Poster Competition & Field-Testing Projects *2023 – Present*
North Carolina A&T State University / Coastal Studies Institute (CSI) *NC*

- Supervised and coached two annual student cohorts (6-8 students each year) in preparing for the NCROEP Symposium Poster Competition, guiding research design, technical writing, and oral presentation skills.
- Organized and led field testing sessions at the Coastal Studies Institute (CSI), providing undergraduate students with hands-on experience in experimental setup, wave energy system deployment, and real-time data collection.
- Fostered student development in marine renewable energy through active mentoring, project management training, and real-world problem-solving.
- Integrated CFD simulations, mechanical design, and environmental context into student-led work to foster interdisciplinary learning.

Course Instructor - Senior Design Project on Wave Energy *2023 – 2024*
North Carolina A&T State University *Greensboro, NC*

- Spearheaded multi-scale experimental projects, from controlled laboratory tests to extensive field trials, ensuring comprehensive data collection and analysis.
- Provided hands-on research mentorship to undergraduate students, fostering their competencies in numerical analysis, experimental methodology, and project management.
- Executed advanced Computational Fluid Dynamics (CFD) simulations to model fluid dynamics, optimizing experimental configurations and design iterations for wave energy systems.
- Contributed to workforce development by mentoring emerging engineers and researchers in wave energy through applied, research-focused projects.
- Supervised students and organized collaborative exchange programs with the Coastal Studies Institute (CSI) to promote experiential learning and knowledge sharing.

Research Assistant for control of the shock train in scramjet isolator engine. *2021-2023*
North Carolina A&T State University *Greensboro, NC*

- Extracted preliminary experimental data to initialize Computational Fluid Dynamics (CFD) simulations.
- Employed high-fidelity CFD techniques to model natural fluid dynamics, capturing shock train phenomena within the scramjet engine's isolator section.
- Utilized CFD to systematically adjust isolator backpressure, enabling detailed analysis of shock train behavior under varying conditions.
- Delivered high-precision simulation data to the machine learning team to support model training and refinement.

Lead Researcher for CFD simulation in the under-expanded jet flow. *2021-2022*
North Carolina A&T State University *Greensboro, NC*

- Applied NCAT's in-house CFD code to simulate unsteady supersonic jet flow, producing video visualizations of fluid dynamics.
- Evaluated the CFD method's capability to capture intricate fluid structures, including eddies and acoustic waves.
- Generated diverse parametric data from simulation results to highlight key fluid dynamic features and outcomes.

Core Researcher for develop third generation of NCAT in-house CFD code – IDS. *2017-present*
North Carolina A&T State University *Greensboro, NC*

- Developed foundational CFD code using Fortran, enabling efficient data processing and simulation.
- Processed data output from the Fortran code and utilized Tecplot for visualizing results through plots and video animations.
- Created an enhanced CFD algorithm informed by physical principles to improve simulation accuracy, achieving low-dissipation results.
- Leveraged high-performance computing (HPC) to run parallelized unsteady flow simulations, implementing OpenMP and MPI for efficient computation.

PUBLICATIONS

Refereed Conference Proceedings

1. Frederick Ferguson, Xinru Niu, **Yang Gao**, Dehua Feng, "Analyzing the Physics within Complex Unsteady Flow Fields", 2026 AIAA, SciTech 4356447.
2. Frederick Ferguson, Xinru Niu, **Yang Gao**, Mookesh Dhanasar, "VERIFYING & VALIDATING THE INTEGRO-DIFFERENTIAL SCHEME CAPABILITY TO SOLVE THE 1D UNSTEADY GAS DYNAMIC EQUATIONS", ASME, FEDSM2025-158616.
3. Frederick Ferguson, Xinru Niu, **Yang Gao**, Dehua Feng, "INVESTIGATING THE INTEGRO-DIFFERENTIAL SCHEME COMPUTATIONAL CAPABILITY TO PREDICT VORTEX DOMINATED FLOW FIELDS", ASME, FEDSM2025-158711.
4. Dehua Feng, Frederick Ferguson, **Yang Gao**, Xinru Niu, "Investigating the Start-Up Structures and Their Evolution Within an Under-Expanded Jet Flows", ASME International Mechanical Engineering Congress and Exposition, IMECE2023-113767.
5. Dehua Feng, Frederick Ferguson, **Yang Gao**, "Numerical Investigation of Rayleigh-Taylor and Richtmyer-Meshkov Instabilities", AIAA AVIATION 2023 Forum, AIAA 2023-3430.
6. Frederick Ferguson, Dehua Feng, **Yang Gao**," Computational Study of Planar Shock Bubble Interactions", AIAA SCITECH 2023 Forum, AIAA 2023-0082.
7. **Yang Gao**, Dehua Feng, Frederick Ferguson," Revealing the Richtmyer-Meshkov Instability Within Gas Dynamic Detonations", ASME 2022 International Mechanical Engineering Congress and Exposition, IMECE2022-95224.
8. Frederick Ferguson, Dehua Feng, **Yang Gao**," Controlling the Flow Structures Within a Scramjet Isolator With Backpressure Manipulations", ASME 2022 International Mechanical Engineering Congress and Exposition, IMECE2022-96157. ***(Moody Award)***

9. **Yang Gao**, Dehua Feng, Frederick Ferguson," High Fidelity Simulations of 2D Riemann and Raleigh-Taylor Instability Problems", AIAA AVIATION 2022 Forum, AIAA 2022-3547.
10. Dehua Feng, **Yang Gao**, Frederick Ferguson, "An Innovative MPI Topology for Direct Computational Fluid Dynamic Simulations", AIAA AVIATION 2022 Forum, AIAA 2022-3975.
11. Frederick Ferguson, **Yang Gao**, Dehua Feng, "Investigating the Unsteady Fluid Physics within Jet Flows", AIAA-SciTech 2022, AIAA 2022-2417.
12. Frederick Ferguson, Dehua Feng, **Yang Gao**, Michael D Atkinson, "Investigating the Unsteady Flow Physics Within a Mach 1.8 Isolator", AIAA-SciTech 2022, AIAA 2022-0369.
13. Frederick Ferguson, Dehua Feng, **Yang Gao**, "Investigating the Unsteady Shock Bubble Multiphase Interactions", AIAA-SciTech 2022, AIAA 2022-1820.
14. **Yang Gao**, Dehua Feng, Larry Thompson, Frederick Ferguson, "An IDS Investigation of the Instability Features Within Jet Flows", *IMECE 2021-70725.*
15. Dehua Feng, **Yang Gao**, Larry Thompson, Frederick Ferguson, "Investigating the Flow Field within Unsteady Compressible Flows", *IMECE 2021-71788*.
16. Frederick Ferguson, **Yang Gao**, Dehua Feng, "Simulating the Perturbation Effects Within an Under-expanded Supersonic Jet". *CASI AERO 2021.*
17. Frederick Ferguson, **Yang Gao**, Dehua Feng, Michael D Atkinson, Julio C Mendez, " Investigating the Unsteady Fluid Physics within Complex Flows Fields'', AIAA SciTech 2021 Forum.
18. Frederick Ferguson, Dehua Feng, **Yang Gao**, Mookesh Dhanasar, Isaiah Blankson, "Deriving Waveriders from Conical Flow Fields with Chemistry'', AIAA SciTech 2021 Forum.
19. Frederick Ferguson, Dehua Feng, **Yang Gao**, "A Computational Investigation of High Reynolds Number Compressible Boundary Layers'', AIAA SciTech 2020 Forum.
20. Frederick Ferguson, **Yang Gao**, Dehua Feng, "A Computational Investigation of Vortex Flows Across Shockwaves'', AIAA SciTech 2020 Forum.
21. Frederick Ferguson, Dehua Feng, **Yang Gao**, "Investigating the Flowfield Physics Within Compressible Turbulent Boundary Layers'', ASME International Mechanical Engineering Congress and Exposition 2019.
22. Tasmin Hossain, Frederick Ferguson, Michael D Atkinson, **Yang Gao**, "An IDS investigation of the flow field physics within compressible boundary layers'', AIP Conference Proceedings 2019.
23. Frederick Ferguson, Dehua Feng, **Yang Gao**, Mookesh Dhanasar, Julio C Mendez, "The Inverse Design of Thrust Optimized Scramjets Derived from Quasi-1D Flowfields'', AIAA SciTech 2019 Forum.
24. Frederick Ferguson, Dehua Feng, **Yang Gao**, Julio C Mendez, David DodooAmoo, "Investigating the Computational Errors of Integral Schemes Through the Use of Numerical Experiments'', AIAA SciTech 2019 Forum.

Refereed Journal Articles

25. Mohammad Nasim Uddin, **Yang Gao**, Paul M Akangah, "Computational Fluid Dynamics Simulation on Blade Geometry of Novel Axial FlowTurbine for Wave Energy Extraction", Energies 2024, 17(14), 3602; https://doi.org/10.3390/en17143602.
26. Frederick Ferguson Tasmin Hossain, Julio Cesar Mendez, **Yang Gao**. "A REVISED ANALYSIS OF THE COMPRESSIBLE BOUNDARY LAYER AT HIGH REYNOLDS NUMBERS AND AT MACH 0.5'', Journal of UAB ECTC 2018.

Dissertation/Thesis

27. **Yang Gao**, "The Fluid Physics Capturing Capability of the Integro-Differential Scheme'', North Carolina Agricultural and Technical State University 2023.
28. **Yang Gao**, "Investigating the Integro-Differential Scheme Performance in Solving Euler Equations'', North Carolina Agricultural and Technical State University 2019.

Academic Conference Presentation

29. **Yang Gao**, "Investigating the Start-up Structures and Their Evolution within an Under-expanded Jet Flows'', *ASME IMECE 2023* Forum, **New Orleans, LA, USA.**
30. **Yang Gao**, "Revealing the Richtmyer-Meshkov Instability Within Gas Dynamic Detonations'', *ASME IMECE 2022* Forum, **Columbus, OH, USA.**
31. **Yang Gao**, "High Fidelity Simulations of 2D Riemann and Raleigh-Taylor Instability Problems'', *AIAA Aviation 2022 Forum*, **Chicago, IL**, **USA.**
32. **Yang Gao**, "Investigating the Unsteady Fluid Physics within Jet Flows'', *AIAA SciTech 2022 Forum*, **San Diego, CA**, **USA.**
33. **Yang Gao**, "An IDS Investigation of the Instability Features Within Jet Flows'', *ASME IMECE 2021*, **Virtual.**
34. **Yang Gao**, "Simulating the Perturbation Effects Within an Under-expanded Supersonic Jet'', *CASI AERO 2021*, **Virtual.**
35. **Yang Gao**, "Investigating the Unsteady Fluid Physics within Complex Flows Fields'', *AIAA SciTech 2020 Forum*, **Virtual**.
36. **Yang Gao**, "A Computational Investigating of Vortex Flows Across Shockwave'', *AIAA SciTech 2019 Forum*, **Orlando, FL, USA**.

Invited Symposia Participation

37. The 14th Annual North Carolina Renewable Ocean Energy Symposium at the Coastal Studies Institute on March 26 and 27, 2025, at the Coastal Studies Institute (CSI) in **Wanchese, NC, USA**.

38. The 13th Annual North Carolina Renewable Ocean Energy Symposium at the Coastal Studies Institute on April 8 and 9, 2024, at the Coastal Studies Institute (CSI) in **Wanchese, NC, USA**.

TEACHING EXPERIENCE

Lecturer
Mechanical Engineering Program, Texas State University, San Marcos, TX
Jan. 2026 – Present

- ME 3151: Smart Instrumentation and Measurement Lab — Spring 2026
- ME 3331: Heat Transfer — Spring 2026

Adjunct Professor
Mechanical Engineering Department, North Carolina A&T State University, Greensboro, NC
Jun. 2023 – Present
ABET approved Mechanical Engineering Courses

- MEEN 104: Graphics for MEEN (SOLIDWORKS CAD Class) — 2023-2024
- MEEN 202: Mechanical Engr. Project Lab (Arduino microcontroller design class) — 2023-present
- MEEN 210: Numerical Methods Using MATLAB — 2023-present
- MEEN 232: Strength of Materials — 2025 Summer
- MEEN 316: Fluid Mechanics — 2025 Summer
- CHEN 300: Fluid Mechanics — 2025 Summer
- MEEN 317: Thermal-Fluid Systems Labora — 2024-Present
- MEEN 319: Aerodynamics and Propul Lab — 2024-Present
- MEEN 343: Heat Transfer — 2025 Summer
- MEEN 480: MEENsrProj-Wave Energy (Senior Project 1) — Each Fall Semester
- MEEN 481: MEENsrProj-Wave Energy (Senior Project 2) — Each Spring Semester

Teaching Assistant
Mechanical Engineering Department, North Carolina A&T State University, Greensboro, NC
Aug. 2019 – May. 2023

- MEEN 685: Special Topics-Numerical Methods
  (Deeply involved in designing course)
- MEEN 626: Advanced Fluid Dynamics
- (Deeply involved in designing course)

Consistently committed to integrating research-driven, hands-on learning experiences into engineering education to foster critical thinking, technical fluency, and professional growth.

WORKSHOPS & TECHNICAL TRAINING

- ✓ **Participant**, *WEC Mock Deployment Workshop*, Coastal Studies Institute (CSI) & Atlantic Marine Energy Center (AMEC), Wanchese, NC, March 28, 2025
  Participated in hands-on demonstrations and operational briefings related to marine energy deployments, including diving, fabrication, rigging, and environmental monitoring.

PROFESSIONAL SERVICE

- ❖ **ABET Accreditation Contribution**

- Assisted the department in preparing for ABET accreditation, managing the FCAR reports and data analysis for seven courses.
- Coordinated curriculum outcome mapping by designing pie charts to align courses with specific ABET Student Outcomes.
- Provided structured documentation and data organization to facilitate the accreditation process.
- Served as Lab Coordinator for ABET inspection, ensuring laboratory compliance by verifying equipment cleanliness and organization, attaching safety documentation to instruments, and confirming availability of Safety Data Sheets (SDS).

❖ **Graduate Student Mentorship & Committee Service**
- **Olaitan Ganiu**, MS, Sliding and Rolling Contact Analysis of Triboelectric Nanogenerator, 2025
- **Xinru Niu**, Ph.D., *Investigating of the Numerical Errors Generated by the Integro-Differential Navier-Stokes Solver*, 2025
- **Valesia R. Davis**, M.S., *A Novel Design of a Heating and Thermal Storage System Using Solar Energy for the Sustainability of Human Exploration on the Lunar Surface*, 2025
- **Sharia Mozella James Flack**, M.S., *Contaminant Dispersion From an Expiratory Event in a Plane Cabin*, 2024
- **Tyler McCoy**, M.S., *1-D Error Analysis of the IDS CFD Scheme*, 2023

❖ Conducted interviews for faculty positions, including **professors and dean-level officers**, serving as a **student and staff representative**.

❖ Supported the establishment of the **Aeronautics and Astronautics Engineering (AAEN) department**, contributing to curriculum development, application documentation, and organizational structuring, leading to university approval.

❖ Guided undergraduate students in scholarship and **honors program applications**.

❖ Actively contributed to drafting proposals for submission to **NSF, Air Force, DoD, and DOE** funding programs.

TECHNICAL SKILLS

- Programming: Proficient in Python, MATLAB, Fortran, and C++ for numerical modeling and data analysis.
- Design & Prototyping: Expertise in SOLIDWORKS for 3D modeling; experienced in Arduino-based prototyping.
- Simulations & Analysis: Skilled in ANSYS, Tecplot, and HPC environments for CFD and wave energy research.
- Laboratory & Testing: Strong capabilities in experimental setup, instrumentation, and multi-scale experiments.
- Project Leadership: Experienced in team management, technical mentoring, and meeting project deadlines

SCHOLARSHIP/AWARD

- **First Place, FEDSM Flow Visualization Competition** – "Visualization of Unsteady Flows Using the High-Fidelity IDS Solver", ASME Fluid Engineering Division Summer Meeting, 2025
- **Second Place, AIAA Flow Visualization Showcase (Most Artistic Flow) –** "Integro-Differential Scheme (IDS) Flow Simulations", AIAA Aviation Forum and Exposition, 2023
- **Lewis F. Moody Award –** "Controlling the Flow Structures Within a Scramjet Isolator with Backpressure Manipulations", ASME Fluid Engineering Division, 2023
- **Full Doctoral Scholarship,** Mechanical Engineering Department, ERC Project, North Carolina A&T State University, 2019–2023
- **Graduate Student Scholarship**, Graduate School Merit Assistantship, North Carolina A&T State University, 2020–2021

PROFESSIONAL MEMBERSHIPS

- American Institute of Aeronautics and Astronautics (AIAA): Members
- American Society of Mechanical Engineers (ASME): Members