XIANZHANG XU

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EDUCATION

University at Buffalo, State University of New York 08/2018 - 08/2023
PhD, Mechanical Engineering

- **Dissertation**: Modeling and Control Wing Maneuvers in Transverse Gust Encounters
- **Main Courses**: Continuous Control System, Optimal Control Systems, Advanced Control Systems Aerodynamics, System Identification, System Analysis, Data Assimilation, Analytical Dynamics, Physical Fluid Dynamics. Flow Estimation and Control
- **GPA**: 3.94/4.0

University of Southampton, United Kingdom 09/2015 -09/2016
MSC, Maritime Engineering Science/ Offshore Engineering

- **Dissertation**: Wave Run Up Analysis Synthesis of Published Experimental Model Investigations of Wind Turbine Monopile Forces
- **Main Courses**: Finite Element Analysis in Solid Mechanics, Ship Manoeuvering and Control, Fundamental of Ship Science, Offshore Engineering Analysis, Marine Structures in Fluids, Maritime Robotics
- **GPA**: 3.53/4.0, **Award**: Merit

Wuhan University of Technology, China 09/2011 -06/2015
Bachelor of Engineering, Maritime Transportation

- **GPA**: 3.75/4.0

MENTOR EXPERIENCE

Center for Naval Research and Education (CNRE) at University of Michigan, Ann Arbor

- Undergraduate research internship program : Jack Zaeske (Fall 2024), Daria Skalitzky (Summer 2025, current Master student at ETH, Zürich)

University at Buffalo, State University of New York

- CFD modeling of maneuvering airfoil in transverse gust encounter: Anoop Kiran (2021-2022), Current PhD student at Brown University

RESEARCH EXPERIENCES

Artificial Intellgence in Computational Fluid Dynamics 2025 - Now

- Investigate the Generative Artificial Intellegence (AI) enhanced method for Computation Fluid Dynamics (CFD) modeling in turbulent flow
- Imporve the turbulent flow modeling efficiency using Neural Operators and diffusion model.
- Accurately obtain the pressure field using physics-informed Generative AI such as diffusion model.

Machine Learning Aided Flow Field Reconstruction from Sparse and Noisy Measurements 2024 - Now

- Develop a data assimilation approach for Flow Field Reconstruction from sparse Particle Tracking Velocimetry (PTV) data using Physics-informed Neural Networks (PINNs).
- Identify the global minimum pressure locations and value in vortex flow where pressure fluctuations and cavitation are expected

- Compare the PINNs model with classical methods such as adjoint approach and proposed the potential hybrid method to improve the performance.
- Quatitatively analysis the PINN model with uncertainties in velocities and spatial coordiantes.
- Validate the method in a twin-vortex turbulent flow simulated using Large Eddy Simulation (LES) model.
- Mentor undergraduate students for Fall and Summer Research Internship program at Center for Naval Research and Education (CNRE)

Configurable Parametric Aeroservoelastic Reduced-order Models for Aerostructural Sensing and Control (NASA) 2023 - 2024

- Construct parametric reduced-order models (ROM) using data-driven methods and couple with physics-based ROMs, design trainning data for system identification.
- Collaborate with industrial partners, support them on software delievery, report writing, and technical presentation in fast-pace.
- Design control synthesis for the coupled ROMs through implementing LQG, MPC control for MIMO system.
- Construct linear parameter varying (LPV) system of an aeroelastic wing in multiple flight conditions using Input-output Dynamic Mode Decomposition (IODMD), controller design for parameter-varying system.

Modeling and Control of Wing Maneuvers in Transverse Gust Encounters (NSF) 2020 - 2023

- Modeled the wing gust encounters using different unsteady aerodynamic models with multi-fildelity.
- Designed control method to regulate the lift response of the wing during the gust encounters.
- Constructed an optimal-control framework for nonlinear fluid systems to generate an optimal lift response closely tracking the reference lift value.
- Developed an iterative method to achieve the optimal control in experiments.
- Collaborated with reseaerchers at the Univeristy of Maryland for experimental validation.

Application of a Nonlienar Disturbance Observer (NDOB) to a Planar Manipulator 2021

- Conducted literature review of nonlinear disturbance observers and time-domain disturbance observers.
- Applied the NDOB to simulate a tracking problem for planar manipulator tracking problem. A feedback linearization method was used for control.

Quasi-steady Effective Angle of Attack and Its Application in Lift-equivalent Design 2019 - 2021

- Derived an expression of quasi-steady effective angle of attack that removes the small-angle assumption and includes wing kinematics and external flow effects.
- Applied the effective angle of attack expression to design maneuvers that mimic the lift response of the wing in a transverse gust encounter.
- Constructed CFD simulations to verify the lift-equivalence of a maneuvering wing and a wing in a transverse gust encounter.

Nonlinear Control of Longitudinal Aircraft Dynamics with a Slung Payload 2020 - 2021

- Derived the dynamics equations of longitudinal fixed-wing UAV with a slung payload.
- Designed a nonlinear controller to track and transit between pre-described or generated on-the-fly flight trajectories.

System Identification using Eigensystem Realization Algorithm (ERA) and Observer Kalman Filter Identification (OKID) 2019

- Applied the Eigensystem Realization Algorithm (ERA) and Observer Kalman Filter Identification (OKID) method to a randomly generated discrete linear system.

Reduced-order Modeling using Dynamic Mode Decomposition and Least Angle Regression 2018 - 2019

- Combined the model-selection algorithm Least Angle Regression with Dynamic Mode Decomposition for reduced-order modeling.
- Compared the proposed method with Sparsity-Promoting Dynamic Mode Decomposition.

Wave Run-up Analysis Published Experimental Data of Wind Turbine Monopile Forces 03/2016 - 09/2016

- Built a model of a monopile, offshore wind-turbine structure and free-surface waves using Fluent.
- Investigated the generation process of an irregular wave sea state from a known wave spectrum using 3D CFD simulations.
- Compared wave run-up height and forces with experimental data.
- Modified the diameter of the monopile to seek differences in predicted results and provide suggestions for design improvement.

Autonomous Underwater Vehicle (AUV) Simulation and Build Design 03/2016 - 04/2016

- Simulated and controlled the speed and depth of an AUV so that it maintains a constant distance of 1m from the seabed.
- Identified a path to avoid collisions with the structure and simulated the vehicle's performance.
- In a group of 5 students, built a simple AUV to dive into the water then go through a gate located at 1m depth and re-surface .

Key Technology for Shipborne 3D Auxiliary Navigation in Complex Weather of Inland Waterways 12/2014 - 01/2015

- Built a 3D traffic environment model with 3Ds Max considering coastal features and static marking.
- Investigated the relevance of dynamic information of vessels using fuzzy comprehensive, Back-Propagation neural network, Euclidean axiom, and grey correlation methods.
- Tested and simulated the system in a laboratory environment and verified the system in a full-scale test.

PUBLICATIONS

- Isobe, T., Tasnim, M., **Xu, X.**, Lagor, F.D., "Modeling and System Identification of a Thin Airfoil Pitching in Ground Effect", *AIAA SciTech 2026 Forum, 2026, In Press.*
- **Xu,X.**, Skalitzky, D., Mahesh, K. "Machine Learning-Aided Estimation of Minimum Pressure from Sparse Velocity Data in Vortex Flows" *Physical Review Fluids, under review, 2025*
- **Xu,X.**, Skalitzky, D., Mahesh, K. "Machine Learning Aided Flow Field Reconstruction from Sparse and Noisy Particle Measurements " *The 78th Annual Meeting of the APS Division of Fluid Dynamics, Abstract for Oral Presentation, 2025*
- **Xu,X.**, et al., "Parametric Flight Control Design for Aeroservoelastic Reduced-order Model with Gust Disturbance " *AIAA AVIATION FORUM AND ASCEND 2024. 2024.*
- **Xu, X.**, Gementzopoulos, A., Sedky, G., Jones, A.R., Lagor, F.D., "Design of Optimal Wing Manvuers in a Transverse Gust Encounter through Iterated Simulation or Experiment," *Theoretical and Computational Fluid Dynamics, 2023*
- **Xu, X.** and Lagor, F.D.,"Simplified Iterative Maneuver Optimization for Lift Mitigation in Transverse Gust Encounters," *AIAA SciTech 2023 Forum,2023.*
- **Xu, X.**, Gementzopoulos, A., Sedky, G., Jones, A.R., Lagor, F.D., "Iterative Maneuver Optimization in a Transverse Gust Encounte," *AIAA Journal, 2023.doi: 10.2514/1.J062404*
- **Xu, X.** and Lagor, F.D., "Optimal Pitching in a Transverse Gust Encounter Using a Modified Goman-Khrabrov Model," *AIAA Aviation FORUM, 2021, p. 2937.*

- **Xu, X.**, and Lagor, F.D., "Quasi-Steady Effective Angle of Attack and Its Use in Lift Equivalent Motion Design," *AIAA Journal, 2021, pp. 1–14.*.
- **Xu, X.**, and Lagor, F.D., "A New Expression for Quasi-Steady Effective Angle of Attack Including Airfoil Kinematics and Flow-Field Nonuniformity," *AIAA SciTech 2020 Forum, 2020, p. 1782.*
- Graff, J., **Xu, X.**, Lagor, F. D., and Singh, T. , "Reduced-order modeling using dynamic mode decomposition and least angle regression," *AIAA Aviation 2019 Forum, 2019, p. 3072.*

GRANT PROPOSAL AND REPORT WRITING EXPERIENCE

- *"Configurable Parametric Aeroservoelastic Reduced-order Models for Aerostructural Sensing and Control "*(NASA), contributed to renewal report, Sub Co-I 2023
- *"An Agent-based Cyber-physical Framework for Autonomous Sensing, Positioning, Navigation, and Control of Mobile Industrial Robots in Dynamic Environments", contributed to methodology writing, 2024*

PROFESSIONAL EXPERIENCE

Research Fellow, University of Michigan, Ann Arbor, MI, 08/2024 - present

- Conduct research in Center of Naval Research and Education.

Postdoctoral Research Fellow, University of South Carolina, SC, 09/2023-08/2024

- Conduct research projects, writing grant proposal, advising PhD student.

Research Assistant, University at Buffalo,NY, 05/2020 - 08/2023

- Designed and built mounting hardware for a Particle Tracking Velocimetry (PTV) system in a towing tank to move the cameras and lighting with the aerodynamic/ hydrodynamic model.
- Mentored an undergraduate student to conduct a research project of simulating a wing in transverse gust encounter in the CFD package COMSOL.

Teaching Assistant, University at Buffalo, NY, 08/2018 - 05/2020

- MAE 436 Flight Dynamics, MAE 278 Introduction to Aerospace Engineering Practice, EAS 208 Dynamics, EAS 230 Engineering Computation.
- Duties: *Grading, holding recitation, lab instruction and guidance on MATLAB. project guidance.*

Instructor, New Channel School, Wuhan, China, 12/2017 - 08/2018

- Instructor of International English Language Testing System (IELTS).

Research Assistant, School of Navigation, Wuhan University of Technology, China, 12/2016-01/2018

- Conduct research projects, writing research proposal report, managing research fundings.

Intrenship at Galbraiths Ship Broker Company in Shanghai, China, 09/2014 - 10/2014

- Sales and Purchase group of ship broker, focusing on the vertical service vessel.

Intrenship at Changhang Fuhai bulk carrier ship, China, 05/2014 - 06/2014

- Sea-crew internship on the bulk carrier vessel

CONFERENCES AND TALKS

Talks

- 78th APS DFD Annual Meeting — Houston, TX, 2025
- AIAA Aviation Forum — Las Vegas, NV, 2024
- ReCoVor Seminar (Remote Colloquium on Vortex-Dominated Flows) — Online 2023

- AIAA SciTech Forum — National Harbor, MD, 2023
- AIAA Aviation Forum — Online 2021
- AIAA SciTech Forum — Orlando, FL, 2020

Conferences

- 78th APS DFD Annual Meeting — 2025
- SciFM25: Scientific Discovery in the Age of AI — 2025
- AIAA SciTech Forum — 2020, 2022, 2023
- AIAA Aviation Forum — 2021,2024
- The RINA Wind Farm Support Vessels Conference — 2016
- The 2016/5th International Conference on Sustainable Energy and Environment Engineering — 2016
- The ICPOE International Academic Conference — 2014

Workshop

- NextProf Engineering Workshop — Ann Arbor, 2025
- U-M Knowldege-Guided Mahcine Learning Workshop — Ann Arbor, 2025

SERVICE

Session Chair

- Selected as the session chair for "APS DFD Annual Meeting: Low-Order Modeling and Machine Learning in Fluid Dynamics: General III" — Houston, TX,2025

Judge

- Volunteer as Judge for 3MT Thesis in the College of Engineering, University of Michigan, Ann Arbor 2025
- Volunteer as Judge for UROP Spring Research Symposium, University of Michigan, Ann Arbor 2025

Reviewer

- *AIAA SciTech Forum*
- *IEEE International Conference on Robotics and Automation (ICRA)*
- *AIAA Journal*
- *ASME Letters in Dynamic Systems and Control*

Volunteer

- Volunteer in University at Buffalo Accepted Students Day — 2023
- Instructor and activity organizer for K-12 STEM Enrichment on the fundamental of flight dynamics — 2020, 2021,2022
- Photographer and video editor for Asian Food Festival — 2022
- Volunteer in STEM Job/Carrier Event — 2019

SKILLS

- **Research**: Aerodynamics, Optimal Control, Nonlinear Control, Physics-informed Deep Learning, Data-driven Modeling, Data Assimilation,AI for Science, CFD, Iterative Learning Control, Analytical Dynamics, Flight Dynamics, Linear Robust Control, Hydrodynamics
- **Programming**: Matlab, Python, Slurm

- **Engineering Applications**: ANSYS Mechanical, Simulink, Fluent, Solidworks, COMSOL, LabView, Inventor, XFOIL, Arduino, PIV/PTV
- **Other**: HPC, LaTeX, 3D Printing, Microsoft Word, Excel, PowerPoint, Adobe PhotoShop, Premier
- **Languages**: English, Chinese (Mandarin)

AWARDS

- MAE Research Competition, Honorable Mention 2021
- Graduation with Merit 2016
- Second Prize Scholarship for Excellent Academic Achievements 2013, 2014
- Merit Student, Wuhan University of Technology 2013, 2014
- Second Rank in Marine Knowledge Competition 2012