



Exponent®
Engineering & Scientific Consulting

James Luo, Ph.D.

Associate | Mechanical Engineering
Houston
+1-832-325-5749 | jluo@exponent.com

Professional Profile

Dr. Luo specializes in mechanical and fluid systems, experimental testing and instrumentation, and engineering modeling and simulation for offshore systems. He applies engineering analysis, laboratory testing, field measurements, and standards-based evaluation to assess performance, reliability, and flow-related behavior in complex systems.

Prior to Exponent, Dr. Luo completed his Ph.D. in Mechanical and Aerospace Engineering at Cornell University. His doctoral research focused on unsteady flows, fluid-structure interaction, and vortex shedding. He designed and operated experimental setups in both laboratory and field environments, integrated sensors and data acquisition hardware, and analyzed test data using signal processing, frequency-domain analysis, and engineering computation in MATLAB and Python.

Before Cornell, Dr. Luo worked in engineering roles involving multi-domain hydrodynamic, aerodynamic, mooring, and structural analysis of offshore wind systems, as well as standards-based review of pressure-containing equipment and engineering work for compliance with DNV, ASME, and API requirements.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Cornell University, 2026

M.S., Mechanical Engineering, Cornell University, 2023

B.S., Mechanical Engineering, University of Texas, Austin, 2019

National Science Foundation Graduate Research Fellowship, 2019

Prior Experience

National Science Foundation Graduate Research Fellow, Cornell University, Ithaca, NY, 2019–2026

Undergraduate Honors Researcher, The University of Texas at Austin, Austin, TX, 2018–2019

Maritime Intern, DNV, Houston, TX, 2018

Naval Engineering Intern, London Offshore Consultants, London, United Kingdom, 2017

Professional Affiliations

American Physical Society (APS)

American Society of Mechanical Engineers (ASME)

Publications

Luo, J. Vortex Dynamics Underlying Force Production in Oscillating Airfoils. Ph.D. thesis, 2026.

Perry, K., Luo, J., Williamson, C. H. K., & Morris, S. "[Melt Dynamics of Ice Cylinders in Cross-Flow Environments](#)." 24th Australasian Fluid Mechanics Conference (AFMC2024), Canberra, Australia, 2024.

Presentations

Luo, J. & Williamson, C. H. K. Modal Force and Vortex Dynamics of an Oscillating Airfoil. Invited presentation, 78th Annual Meeting of the APS Division of Fluid Dynamics, Houston, TX, 2025.

Luo, J. The Vortex and Force Dynamics of the Biased Oscillating NACA0012 Airfoil. The 4th Colloquium on Vortex Dominated Flows, Bozeman, MT, 2025.

Perry, K., Luo, J., Williamson, C. H. K., & Morris, S. Vortex Dynamics of Singular and Tandem Ice Cylinders in a Cross-flow. The 4th Colloquium on Vortex Dominated Flows, Bozeman, MT, 2025.

Luo, J. & Williamson, C. Drag-Thrust Transition of the Oscillating NACA0012 Airfoil at Varying Pitch Biases. 77th Annual Meeting of the APS Division of Fluid Dynamics, Indianapolis, IN, 2024.

Luo, J., Morris, S. E., & Williamson, C. Full-Scale Flow Visualization of the Maneuvering Racing Sailboat. 76th Annual Meeting of the APS Division of Fluid Dynamics, Washington, DC, 2023.

Luo, J. & Williamson, C. H. K. Vortex Shedding Modes of the Self-Propelled Airfoil. 75th Annual Meeting of the APS Division of Fluid Dynamics, Indianapolis, IN, 2022.

Luo, J., Young, J., & Williamson, C. H. K. Lift Production of an Unsteady Self-Propelled Airfoil. 74th Annual Meeting of the APS Division of Fluid Dynamics, Phoenix, AZ, 2021.

Young, J., Luo, J., & Williamson, C. Cyber-Physical Approach to a Self-Propelled Flapping Airfoil. 73rd Annual Meeting of the APS Division of Fluid Dynamics, 2020.

Project Experience

Experimental Testing & Instrumentation

Designed and operated custom water channel experimental platforms integrating National Instruments (NI) data acquisition hardware, LabVIEW-based control systems, motion control hardware, force/torque transducers, and optical diagnostics to enable synchronized measurement and quantitative evaluation of mechanical and fluid systems under controlled test conditions. Set up and supported wind tunnel, combustion engine, and flow visualization experiments.

Unsteady Flows, Vortex Shedding, and Aerodynamics

Investigated unsteady flows, vortex shedding, vortex-induced vibration (VIV), and aerodynamic performance in mechanical and fluid systems, supported by the Air Force Office of Scientific Research.

Developed reduced-order and physics-based models to interpret system response, connect measured flow behavior to loading, and understand complex unsteady flows.

Standards & Compliance Review

Reviewed and verified that pressure-containing equipment and related components complied with DNV, ASME, and API requirements. Witnessed site testing to confirm compliance with applicable standards and developed an application to automate pre-approval screening of valves and flanges against code requirements, significantly reducing manual review time and improving design-review efficiency.

Offshore & Marine Systems

Performed multi-domain hydrodynamic, aerodynamic, mooring, and structural analysis of offshore wind systems, including modeling of floating offshore wind concepts and related marine systems using engineering simulation tools including ANSYS and OrcaFlex. Deployed field instrumentation of sailing vessels through sensor integration and interpretation of test data in real operating conditions.

Data Analysis & Engineering Computation

Applied MATLAB, Python, ANSYS-based FEA and CFD tools, and engineering analysis workflows to process experimental data, develop diagnostic and visualization tools, and support technically grounded evaluation of complex systems.