Kianoosh Yousefi

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Professional Appointments

2023 – Present	**Assistant Professor** Department of Mechanical Engineering, University of Texas at Dallas, Richardson, TX, USA
2021 – 2023	**Associate Research Scientist** Department of Civil Engineering and Engineering Mechanics, Columbia University, New York, NY
2020 – 2021	**Postdoctoral Researcher** School of Marine Science and Policy, University of Delaware, Newark, DE, USA
2016 – 2020	**Research Assistant** School of Marine Science and Policy, University of Delaware, Newark, DE, USA

Education

2015 – 2020	Ph.D., Mechanical Engineering, University of Delaware, Newark, DE, USA Thesis: Turbulence in the atmospheric wave boundary layer
2010 – 2013	M.S., Mechanical Engineering, Islamic Azad University, Mashhad, Iran Thesis: Investigation of various parameters of suction and blowing and their influence on aerodynamic characteristics of NACA 0012 airfoil
2005 – 2009	B.S., Mechanical Engineering, Islamic Azad University, Mashhad, Iran Thesis: Selection of a gas turbine cooling system

Honors and Awards

2021	**Computing Innovation Fellowship**, National Science Foundation (NSF), Sub-awarded through the Computing Research Association (CRA).
2020	**Professional Development Award**, University of Delaware, Newark, DE, USA, $2,000.
2019	**Summer Doctoral Fellowship**, University of Delaware, Newark, DE, USA, $4,200.
2019	**Travel Grant for Early Career Scientist Interdisciplinary Workshop**, Ocean Observatories Initiative (OOI), Washington, DC, USA, $2,500.
2018	**Travel Grant for Early Career Interdisciplinary Workshop**, Ocean Observatories Initiative (OOI), Washington, DC, USA, $2,500.
2018	**Travel Grant for Early Career Data Workshop**, Ocean Observatories Initiative (OOI), New Brunswick, NJ, USA, $2,500.
2017	**Professional Development Award**, University of Delaware, Newark, DE, USA, $800.
2015 – 2020	**Doctoral Fellowship**, University of Delaware, Newark, DE, USA.
2015 – 2020	**Tuition Waiver Scholarship**, University of Delaware, Newark, DE, USA.
2014	**The Best Master's Thesis in Mechanical Engineering of the Year**, Iran.
2012	**Ranked 2^{ed} in GPA among master students of Mechanical Engineering Department**, Islamic Azad University, Mashhad, Iran (graduated summa cum laude).
2010 – 2011	**Tuition Waiver Scholarship**, Islamic Azad University, Mashhad, Iran.

RESEARCH INTERESTS

Primary Research Interests: Air-Sea interactions, turbulence and mixing at free surfaces, turbulent boundary layer and airflow separation above surface waves, breaking waves. Secondary Research Interests: Aerodynamics, flow control methods, active and passive flow control techniques, turbulence over wings and airfoils.

RESEARCH EXPERIENCE

2021 – 2023 **Associate Research Scientist**, Mentored by Dr. Marco G. Giometto
Department of Civil Engineering & Engineering Mechanics, Columbia University, New York, NY, USA

Multiscale modeling of hurricane boundary-layer flows
Overview: The fundamental mechanisms responsible for momentum, heat, and moisture transfer in turbulent flows over water bodies are studied using a combination of (pre-existing) experiments and DNSs to develop a numerical model of air-sea fluxes for use in LES. The new LES framework is leveraged to examine the structure of mean flow and turbulence in hurricane boundary-layer flows.

2020 – 2021 **Postdoctoral Researcher**, Mentored by Prof. Fabrice Veron
School of Marine Science and Policy, University of Delaware, Newark, DE, USA

Turbulence and coherent structures across wind-driven surface waves
Overview: A comprehensive set of laboratory experiments was performed to concurrently measure the flow on both sides of the water surface and evaluate the coupling between the air- and water-side turbulent coherent structures and the contribution of the wavy interface on interfacial fluxes.

2016 – 2020 **Research Assistant**, Advised by Prof. Fabrice Veron
School of Marine Science and Policy, University of Delaware, Newark, DE, USA

Turbulence in the atmospheric wave boundary layer
Overview: An unprecedented dataset of high-resolution velocity measurements (a combination of PIV and LIF techniques) was acquired above the air-water interface to examine the modulation of airside turbulence structure and momentum and energy budgets by the presence of wind waves.

2020 **Visiting Student Research Collaborator**, Advised by Dr. Luc Deike, January – March 2020
Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, NJ, USA

Modulation instability and breaking dynamics of a nonlinear wave train
Overview: Direct numerical simulations of air–water flows were performed (using the Basilisk flow solver) to explore the details of wave breaking dynamics and examine the geometric and kinematic breaking criteria to determine the onset of breaking as a function of Re number and wave steepness.

2011 – 2013 **Research Assistant**, Advised by Dr. Reza Saleh
Department of Mechanical Engineering, Islamic Azad University, Mashhad, Iran

Suction and blowing flow control on the NACA 0012 airfoil
Overview: The effects of suction and blowing flow control techniques on the aerodynamic characteristics of a rectangular wing with a NACA 0012 profile were numerically studied, and the optimal jet parameters, including amplitude, width, angle, and momentum coefficient, were determined.

RESEARCH GRANT SUPPORT

1. **The evolution and characteristics of turbulent coherent structures over surface waves**
   Sponsor: National Science Foundation
   Award #: Pending
   PI/Co-PIs: PI: **Yousefi, K.**, Co-PI: Veron, F.
   Duration: May 1, 2022 – April 30, 2024
   Amount: $385,473
   Summary: In this project, we assess the wave modulation effects on the evolution of vorticity and coherent structures by examining the generation and transport of mean, wave, and turbulent vorticity and enstrophy and establish a definitive criterion for identifying airflow separation events over surface waves using readily available variables that can be used for operational weather forecast models.

2. **Wall-layer model for turbulent air-sea interaction processes above ocean waves**
   Sponsor: Research Initiatives in Science and Engineering (RISE), Columbia University
   Award #: Pending
   PI/Co-PIs: PI: Giometto, M. G., Co-PI: **Yousefi**, **K.**, Zappa, C. J.
   Duration: June 1, 2022 – May 31, 2024
   Amount: $160,000
   Summary: By leveraging unique laboratory and field measurements of the surface skin friction, we develop a high-fidelity physics-based air-sea interaction model, i.e., wall-layer model, for representing small-scale turbulent processes in the simulation of large-scale atmospheric boundary layer flows above ocean surface waves.

3. **Multiscale modeling of hurricane boundary-layer flows**
   Sponsor: National Science Foundation, sub-awarded through Computing Research Association
   Award #: 2030859
   PI/Co-PIs: PI: Giometto, M. G., Co-PI: **Yousefi**, **K.** (Fellow)
   Duration: January 1, 2021 – December 31, 2022
   Amount: $259,605
   Summary: Large-eddy and direct numerical simulation techniques are employed to examine the structure of the turbulence in hurricane boundary-layer flows. This collaborative work is performed as part of the Computing Innovation (CI) Fellowship mentored by Dr. Marco Giometto at Columbia University.

4. **Modulation instability and breaking dynamics of a nonlinear wave train**
   Sponsor: University of Delaware
   Duration: January 1, 2020 – March 1, 2020
   Amount: $4,200
   Summary: This grant represents seed money for a short-term project to perform a preliminary numerical study on details of wave breaking dynamics in Dr. Luc Deike Research Group at Princeton University.

PUBLICATIONS†

Peer-Reviewed Journal Articles

1. **Yousefi**, **K.**, Veron, F. & Buckley, M. P. 2021 Turbulent and wave kinetic energy budgets in the airflow over wind-generated surface waves. *Journal of Fluid Mechanics*, 920, A33.
2. Buckley, M. P., Veron, F. & **Yousefi**, **K.** 2020 Surface viscous stress over wind-driven waves with intermittent airflow separation. *Journal of Fluid Mechanics*, 905, A31.
3. **Yousefi**, **K.**, Veron, F. & Buckley, M. P. 2020 Momentum flux measurements in the airflow over wind-generated surface waves. *Journal of Fluid Mechanics*, 895, A15.
4. **Yousefi**, **K.** & Veron, F. 2020 Boundary layer formulations in orthogonal curvilinear coordinates for flow over wind-generated surface waves. *Journal of Fluid Mechanics*, 888, A11.
5. Husain, N. T., Hara, T., Buckley, M. P., **Yousefi**, **K.**, Veron, F. & Sullivan, P. P. 2019 Boundary layer turbulence over surface waves in a strongly forced condition: LES and observation. *Journal of Physical Oceanography*, 49 (8), 1997-2015.
6. **Yousefi**, **K.** & Saleh, R. 2015 Three-dimensional suction flow control and suction jet length optimization of NACA 0012 wing. *Meccanica*, 50 (6), 1481-1494.
7. Zahedi, P., Saleh, R., Moreno-Atanasio, R. & **Yousefi**, **K.** 2014 Influence of fluid properties on bubble formation, detachment, rising and collapse; Investigation using volume of fluid method. *Korean Journal of Chemical Engineering*, 31 (8), 1349-1361.
8. **Yousefi**, **K.**, Saleh, R. & Zahedi, P. 2014 Numerical study of blowing and suction slot geometry optimization on NACA 0012 airfoil. *Journal of Mechanical Science and Technology*, 28 (4), 1297-1310.

† Underline* indicates supervised graduate students, and underline† indicates mentored postdoctoral researchers.

9. **Yousefi**, **K.** & Saleh, R. 2014 Effects of trailing edge blowing on aerodynamic characteristics of the NACA 0012 airfoil and optimization of the blowing slot geometry. *Journal of Theoretical and Applied Mechanics*, 52 (1), 165-179.
10. Zahedi, P. & **Yousefi**, **K.** 2014 Effects of pressure and carbon dioxide, hydrogen and nitrogen concentration on laminar burning velocities and NO formation of methane–air mixtures. *Journal of Mechanical Science and Technology*, 28 (1), 377-386.

Book Chapters

1. **Yousefi**, **K.**, Veron, F. & Buckley, M. P. 2020 Measurements of airside shear- and wave-induced viscous stresses over strongly forced wind waves. In *Recent Advances in the Study of Oceanic Whitecaps* (ed. P. Vlahos & E. C. Monahan), chap. 6, pp. 77-94. Cham, Switzerland: Springer.

Peer-Reviewed Conference Proceedings

1. **Yousefi**, **K.** & Razeghi, A. 2018 Determination of the critical Reynolds number for flow over symmetric NACA airfoils. In *AIAA Aerospace Sciences Meeting*, AIAA 2018-0818, Kissimmee, FL, USA.
2. **Yousefi**, **K.**, Saleh, R. & Zahedi, P. 2013 Numerical investigation of suction and length of suction jet on aerodynamic characteristics of the NACA 0012 airfoil. In *International Journal of Materials, Mechanics, and Manufacturing: Proceedings of the 2nd International Conference on Fluid Dynamics and Thermodynamics Technologies*, Istanbul, Turkey, vol. 1, pp. 136-142.
3. Zahedi, P., Javadi, S. M., **Yousefi**, **K.** & Pakdel, A. 2013 Experimental and numerical investigation of air suction in domestic gas-burning heaters to increase efficiency. In *International Journal of Materials, Mechanics, and Manufacturing: Proceedings of the 2nd International Conference on Fluid Dynamics and Thermodynamics Technologies*, Istanbul, Turkey, vol. 1, pp. 143-147.

Manuscripts under Review & in Preparation

1. **Yousefi**, **K.** & Veron, F. On the airflow separation above surface wind waves: A review. *Journal of Physical Oceanography*. In Preparation.
2. **Yousefi**, **K.**, Veron, F. & Buckley, M. P. Invariants of the velocity-gradient tensor over surface wind waves. *Journal of Fluid Mechanics*. In Preparation.
3. Addona, F., **Yousefi**, **K.** & Veron, F. The couplings of turbulent coherent structures on both sides of a wind-driven air-water interface. *Physics of Fluids*. In Preparation.
4. **Yousefi**, **K.**, Addona, F., Veron, F., Buckley, M. P. & Jaquette, R. Modulations of turbulent stress transport equation above strongly forced wind waves. *Philosophical Transactions of the Royal Society A*. In Preparation.

PRESENTATIONS†

Invited Talks

1. **Yousefi**, **K.** 2022 The structure of small-scale turbulence in the wave boundary layer. Department of Mechanical and Materials Engineering, Portland State University, Portland, OR, USA.
2. **Yousefi**, **K.** 2022 The impact of wind-generated surface waves on near-surface turbulence and momentum fluxes. Department of Mechanical Engineering, University of Texas at Dallas, Richardson, TX, USA.
3. **Yousefi**, **K.** 2022 Modulation of air-sea fluxes by ocean wind waves. Department of Mechanical Engineering, University of Texas Rio Grande Valley, Edinburg, TX, USA.
4. **Yousefi**, **K.** 2022 Turbulence and momentum fluxes above surface waves. Department of Mechanical and Materials Engineering, Florida International University, Miami, FL, USA.

Conference Presentations

1. **Yousefi**, **K.**, Zappa, C. J. & Giometto, M. G. 2022 Wind stress modeling above ocean waves based on a dynamic surface roughness approach. In *AGU Fall Meeting*, Chicago, IL, USA.

† Underline* indicates supervised graduate students, and underline† indicates mentored postdoctoral researchers.

2. Yang, H.*, Hora, G. S., Veron, F., **Yousefi**, **K.** & Giometto, M. G. 2022 Estimation of surface viscous stress from wave profiles using deep neural network. In *75th Annual Meeting of the APS Division of Fluid Dynamics*, Indianapolis, IN, USA.

3. **Yousefi**, **K.**, Zappa, C. J. & Giometto, M. G. 2022 Dynamic surface drag modeling of wind over ocean waves. In *75th Annual Meeting of the APS Division of Fluid Dynamics*, Indianapolis, IN, USA.

4. **Yousefi**, **K.** & Giometto, M. G. 2022 Surface wind stress model for turbulent flows above ocean surface waves. In *Networking and Information Technology Research and Development* (*NITRD*) *Symposium*, Washington, DC, USA.

5. **Yousefi**, **K.** & Veron, F. 2020 The effects of surface wind waves on the atmospheric wave and turbulent kinetic energy budgets. In *73rd Annual Meeting of the APS Division of Fluid Dynamics*, Chicago, IL, USA.

6. **Yousefi**, **K.**, Veron, F. & Buckley, M. P. 2020 Momentum flux budgets across the air-water interface under strongly forced wind conditions. In *Ocean Sciences Meeting*, San Diego, CA, USA.

7. **Yousefi**, **K.**, Veron, F. & Buckley, M. P. 2019 Wave- and shear-induced viscous stress over wind waves. In *72nd Annual Meeting of the APS Division of Fluid Dynamics*, Seattle, WA, USA.

8. **Yousefi**, **K.**, Veron, F., Buckley, M. P., Husain, N. T. & Hara, T. 2018 Measurements of turbulent stress over wind-driven surface waves in the wave-boundary layer. In *71st Annual Meeting of the APS Division of Fluid Dynamics*, Atlanta, GA, USA.

9. **Yousefi**, **K.**, Veron, F., Buckley, M. P., Husain, N. T. & Hara, T. 2018 Measurements of turbulent stress in curvilinear coordinates over wind-driven surface waves. In *21st Conference on Air-Sea Interaction*, Oklahoma City, OK, USA.

10. Veron, F., **Yousefi**, **K.**, Buckley, M. P., Hussain, N. T. & Hara, T. 2018 Turbulent and wave-induced velocity fields over wind-driven surface waves. In *B'Waves 2018*, Marseille, France. (Invited Presentation)

11. Husain, N. T., Buckley, M. P., **Yousefi**, **K.**, Hara, T., Veron, F. & Sullivan, P. P. 2018 Wind turbulence over surface waves in a strongly forced condition – LES and observation. In *Ocean Sciences Meeting*, Portland, OR, USA.

12. **Yousefi**, **K.**, Buckley, M. P., Veron, F., Husain, N. T. & Hara, T. 2017 Viscous and turbulent stress measurements over wind-driven surface waves. In *AGU Fall Meeting*, New Orleans, LA, USA.

13. **Yousefi**, **K.**, Buckley, M. P., Veron, F., Husain, N. T. & Hara, T. 2017 Wave-induced momentum flux over wind-driven surface waves. In *70th Annual Meeting of the APS Division of Fluid Dynamics*, Denver, CO, USA.

14. Hara, T., Husain, N. T., Buckley, M. P., **Yousefi**, **K.**, Veron, F. & Sullivan, P. P. 2017 Wave boundary layer turbulence over surface waves in a strongly forced condition – LES and observation. In *IUTAM Symposium Wind Waves*, London, UK.

15. Veron, F., Buckley, M. P. & **Yousefi**, **K.** 2017 Airflow separation effects on the surface stress and TKE production over wind-driven waves. In *European Geophysical Union General Assembly*, EGU2017-17601, Vienna, Austria.

16. Zahedi, P. & **Yousefi**, **K.** 2014 Numerical analysis of laminar flame speed for H_2-NH_3-air mixtures in premixed jet flames. In *5th Fuel & Combustion Conference of Iran*, Tehran, Iran.

17. Zahedi, P. & **Yousefi**, **K.** 2013 Volume of fluid simulation investigations on bubble bursting at a free surface. In *15th Conference on Fluid Dynamics*, Bandar Abbas, Iran.

18. **Yousefi**, **K.** 2013 Two-dimensional vortex panel numerical method for the flow around NACA 0012 airfoil. In *National Conference on Mechanical Engineering*, Malayer, Iran.

19. **Yousefi**, **K.**, Saleh, R., Zahedi, P. & Noori, Y. 2013 Numerical investigation of moving surface boundary-layer control on NACA 0012 airfoil and comparison with tangential and perpendicular blowing. In *21st Annual International Conference on Mechanical Engineering (ISME)*, Tehran, Iran.

20. Noori, Y., Zafarmand, B., Amiri, H. & **Yousefi**, **K.** 2013 Simulation of laminar and turbulent flow inside divergent channels by using random vortex method (RVM). In *21st Annual International Conference on Mechanical Engineering (ISME)*, Tehran, Iran.

21. Zahedi, P., Kouhestani, A. A. & **Yousefi**, **K.** 2013 Effects of pressure enhancement and the laminar flame speed of CH_4/air diluted with CO_2, H_2, and N_2. In *21st Annual International Conference on Mechanical Engineering (ISME)*, Tehran, Iran.
22. Zahedi, P., Saleh, R. & **Yousefi**, **K.** 2013 Volume of fluid numerical simulation and investigating effects of surface tension on bubble formation. In *National Conference on Applied Research in Engineering Science*, Takestan, Iran.
23. **Yousefi**, **K.**, Saleh, R. & Zahedi, P. 2012 Investigation for increase or decrease the lift and drag coefficients on the airfoil with suction and blowing. In *International Conference on Mechanical Engineering and Advanced Technology*, Isfahan, Iran.
24. **Yousefi**, **K.** & Zahedi, P. 2012 Numerical investigation on the laminar flame speed of CH_4/air diluted with CO_2 and water vapor. In *International Conference on Mechanical Engineering and Advanced Technology*, Isfahan, Iran.

TEACHING EXPERIENCE

Instructor of Record, Department of Mechanical Engineering, University of Texas at Dallas, Richardson, TX, USA

Undergraduate Courses
- Fluid Mechanics (MECH 3315) Spring 2023

Graduate Courses
-

Teaching Assistant, Department of Mechanical Engineering, University of Delaware, Newark, DE, USA
- Thermodynamics (MEEG 341) Fall 2015

Teaching Assistant, Department of Mechanical Engineering, Islamic Azad University, Mashhad, Iran
- Fluid Mechanics Fall 2011, Spring 2012
- Thermodynamics Fall 2012
- Advanced Fluid Mechanics Spring 2013

MENTORING EXPERIENCE

Graduate Students

2021 – Present **Hongshuo Yang** (Co-advised with Dr. Giometto), M.S., Computer Science, Columbia University.
Project: Estimation of surface viscous stress from wave profiles using deep neural network

Undergraduate Students
- Rohan Sonakya, 2022 – present.

PROFESSIONAL AND PUBLIC SERVICES

Proposal Reviewer
- Engineer Research and Development Center (ERDC).

Journal Reviewer
- Journal of Fluid Mechanics, Fluid Dynamics Research, Progress in Computational Fluid Dynamics, Aerospace, Engineering Applications of Computational Fluid Mechanics, Journal of Mechanical Science and Technology, Journal of Applied Fluid Mechanics, Energies, Applied Sciences, Lubricants, Ocean Engineering, Journal of the Brazilian Society of Mechanical Sciences and Engineering, Engineering Research Express.

Conference Reviewer
- ASME International Mechanical Engineering Congress & Exposition, 2021 – Present.
- ASME Fluids Engineering Division Summer Meeting, 2016 – Present.
- International Conference on Physics, Mathematics, and Statistics, Shanghai, China, 2018.

Synergistic Activities

2021 – Present	**Grad LEAP Mentor**, University of Delaware: The Leveraging Engaged Alumni Program (LEAP) is a mentorship program in which mentors provide holistic support for graduate students, including guidance on research challenges, professional development, and building a professional network.
2021 – 2022	**Pitch:90 Judge Panelist**, Delaware Environmental Institute, Newark, DE: Pitch:90 is an elevator pitch competition in which researchers describe their work in 90 seconds to a panel of judges and an enthusiastic audience.
2021	**Delaware 4–H Youth Development Instructor**, Camp Barnes, DE: Developed outreach/teaching materials on environmental- and ocean-related topics for K-12 campers in Delaware 4–H program.
2019	**LEAD Ally**, University of Delaware, DE: The Leveraging Equity and Diversity (LEAD) program offers a structured approach for professional development in diversity, equity, and inclusion (DEI) and provides opportunities to engage in specific and timely topics related to DEI.
2018 – Present	**Member of OOI Early Career Scientist Community of Practice**, Ocean Observatories Initiative, Washington, DC: Developed and promoted a community of practice around open science and ocean observatory data to address challenging public and scientific questions in marine science.

PROFESSIONAL AFFILIATIONS

2017 – Present	American Physical Society (APS)
2016 – Present	Member of American Institute of Aeronautics and Astronautics (AIAA)
2011 – Present	Member of American Society of Mechanical Engineers (ASME)