Wei ZHANG

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APPOINTMENTS

Associate Professor 2024 –Present
Civil, Environmental and Construction Engineering, Texas Tech University, Lubbock, TX

Associate Professor 2020 – 2024
Mechanical Engineering, Cleveland State University, Cleveland, Ohio

Co-director of the IERS Center 2022 –2024
Center for Integrated Modeling for Energy, Resilience and Sustainability (IERS), Cleveland State University, Cleveland, Ohio

Visiting Professor Spring 2023
Civil and Environmental Engineering, Case Western Reserve University, Cleveland, Ohio

Visiting Professor Summer 2016
Laboratory of Wind Engineering and Renewable Energy (WIRE), École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland

Assistant Professor 2014 – 2020
Mechanical Engineering, Cleveland State University, Cleveland, Ohio

Postdoctoral Associate 2009 – 2014
Saint Anthony Falls Laboratory, University of Minnesota, Minneapolis, Minnesota

EDUCATION

Ph.D., Mechanical Engineering (Thermo-Physics and Fluids Engineering) 1999 – 2003
Xi'an JiaoTong University, Xi'an, China

Dissertation: "Experimental and Numerical Studies of Unsteady Rotor-Stator Interactions in Compressors"

B.S. & M.S., Civil and Environmental Engineering 1992 – 1999
Xi'an University of Architecture and Technology, Xi'an, China

HONORS AND AWARDS

- CSU Distinguished Faculty Awards Nominee (Research Track), 2021
- NSF CAREER Award, 2020
- Faculty advisor of the *first-place* team in the International Design Competition at the AIAA Science and Technology Forum and Exposition's International Conference, 2016
- NSF ADVANCE Travel Grant, 2008
- Best Paper Prize from the Korean Nuclear Society, 2005
- Brain Korea 21 Research Fellowship, 2003 – 2006

RESEARCH INTERESTS

- Vortex dynamics at high Reynolds numbers for wind hazard mitigation;
- Imaging-based flow measurement techniques (PIV/PTV, LPT, high-speed photography);
- Bio-inspired flow control strategy for wind resilience of the built environment and energy efficiency;
- Wind turbine wake modeling (turbine wake aerodynamics, wake-ABL interactions, and wind-farm effects on local meteorology and environment);
- Atmospheric boundary-layer flows over complex terrain (e.g., canopies, hills and mountains, water surface) and land-atmosphere interaction.

RESEARCH GRANTS

- National Science Foundation (NSF) CMMI ECI #1944776, "CAREER: Flow Physics of Transient Rooftop Vortices at High Reynolds Number and Bio-inspired Flow Control to Mitigate Wind Hazards", $707,877 (PI, 03/2020 – 02/2025).
- NSF DEEC #2150000 "Collaborative Research: REU Site: The Great Lakes Wind Energy Challenges (REU-GLWind)", $425,897 (PI, share of $217,099, in collaboration with Case Western Reserve University, 09/2022 – 08/2025)
- NSF OISE #1952549, "Collaborative Research: IRES Track I: US-South Korea Collaboration on Biomimicry and Bio-inspired Fluid Flows (BIO-FLOWS)", $299,999 (PI, share of $194,998, in collaboration with the multi-disciplinary teams at University of Akron, Case Western Reserve University and POSTECH, South Korea, 09/2020 – 08/2025).
- Department of Higher Education Modeling and Simulation Program (M&SP), "Building A Modeling and Simulation-Based Multidisciplinary Learning Environment for Capacity Transformation in Urban Universities: Sustainable Energy Systems and Beyond", $1,009,852 (Senior Personnel, 1-month effort per year, 01/2023 – 12/2025)

PEER-REVIEWED JOURNAL PAPERS [Google Scholar Citations]

26. **Zhang, W.**, C. D. Markfort, and F. Porté-Agel. 2023. Wind-Tunnel Experiments of Turbulent Wind Fields over a Two-dimensional (2D) Steep Hill: Effects of the Stable Boundary Layer. *Boundary-Layer Meteorology*, *188, 441-461*. https://doi.org/10.1007/s10546-023-00820-2

25. E. Shelley, E. Hubbard, and **Zhang, W.** 2023. Comparison and uncertainty quantification of roof pressure measurements using the NIST and TPU Aerodynamic Databases. *Journal of Wind Engineering and Industrial Aerodynamics*, 232, 105246. https://doi.org/10.1016/j.jweia.2022.105246

24. **Zhang, W.** and Gruber, P. 2020. Wind-resilient Civil Structures: What Can We Learn from Nature. *Botany*, 98(1): 37-48. https://doi.org/10.1139/cjb-2019-0034

23. A. Razavi, **Zhang, W.**, P. P. Sarkar. 2018. Effects of ground roughness on near-surface flow field of a tornado-like vortex. *Experiments in Fluids*, 59:170. https://doi.org/10.1007/s00348-018-2625-x

22. A. Omilion, J. Turk, and **Zhang, W.** 2018. Turbulence enhancement by fractal square grids: Effects of multiple fractal scales. *Fluids*, 3, 37. https://doi.org/10.3390/fluids3020037

21. J. Bunjavec, J. Turk, A. Rinehart, and **Zhang, W.** 2018. Wake induced by a real seal whisker. *Journal of Visualization*, 21, 11; 1-16. (**one of 31 selected from 256 presentations at the ISPIV 2017 Conference**) https://doi.org/10.1007/s12650-018-0484-4

20. C. D. Markfort, **Zhang, W.**, and F. Porté-Agel. 2018. Analytical model for mean flow and fluxes of momentum and energy in very large wind farms. *Boundary-Layer Meteorology*, 166: 31-49. https://doi.org/10.1007/s10546-017-0294-6

19. A. Rinehart, V. Shyam, and **Zhang, W.** 2017. Characterization of seal whisker morphology: Implication for whisker-inspired flow control applications. *Bioinspiration and Biomimetics*. 12:066005. https://doi.org/10.1088/1748-3190/aa8885 (**Featured paper of the month**)

18. S. McClure, J.J. Kim, S.J. Lee, and **Zhang, W.** 2016. Sheltering effects of multi-scale fractal wind fences. *Journal of Wind Engineering and Industrial Aerodynamics*. 163: 6-14. https://doi.org/10.1016/j.jweia.2017.01.007

17. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2013. Wind-turbine wakes in a convective boundary layer: a wind-tunnel study. *Boundary-Layer Meteorology*, 30(2): 274-287. https://doi.org/10.1007/s10546-012-9751-4

16. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2013. Experimental study of the impact of large-scale wind farms on land-atmosphere exchanges. *Environmental Research Letter*, 8 015002. https://doi.org/10.1088/1748-9326/8/1/015002

15. C.D. Markfort, **Zhang, W.**, and F. Porté-Agel. 2012. Turbulent flow and scalar flux through and over aligned and staggered wind farms. *Journal of Turbulence*, 13(1)-33: 1-36. https://doi.org/10.1080/14685248.2012.709635

14. **Zhang, W.**, P.P. Sarkar. 2012. Near-ground tornado-like vortex revealed by Particle Image Velocimetry. *Experiments in Fluids*, 52(2): 479-493. https://doi.org/10.1007/s00348-011-1229-5

13. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2012. Near-wake structure downwind of a wind turbine in a turbulent boundary layer. *Experiments in Fluids*, 52(5): 1219-1235. https://doi.org/10.1007/s00348-011-1250-8

12. D.W. Wang, Y. Wang, Bin Yang and **Zhang, W.** 2009. Research on Sand Saltation Splash Function by High Speed Digital Camera. *Journal of Xi'an Jiaotong University*, 43(7): 125-128.

11. **Zhang, W.**, R. Hain, and C.J. Kähler. 2008. Scanning PIV investigation of the laminar separation bubble on an SD7003 airfoil. *Experiments in Fluids*, 45(4):725-743. https://doi.org/10.1007/s00348-008-0563-8

10. **Zhang, W.**, Y. Wang, and S.J. Lee. 2008. Simultaneous measurements of desert sand and wind velocities in saltation by PIV and PTV. *Experiments in Fluids*, 45(2): 241-256. https://doi.org/10.1007/s00348-008-0474-8

9. D.W. Wang, Y. Wang, Bin Yang and **Zhang, W.** 2008. Statistical analysis of sand grain/bed collision process recorded by high speed digital camera. *Sedimentology*, 55(2): 461-470. https://doi.org/10.1111/j.1365-3091.2007.00909.x

8. **Zhang, W.**, Y. Wang, and S.J. Lee. 2007. Two-phase measurements of saltating sand and wind velocities in an atmospheric boundary layer. *Geomorphology*, 88(2): 101-119. https://doi.org/10.1016/j.geomorph.2006.10.017

7. **Zhang, W.**, J.H. Kang, and S.J. Lee. 2007. Tracking of saltating sand trajectories over a flat surface embedded in an atmospheric boundary layer. *Geomorphology*, 86: 320-331. https://doi.org/10.1016/j.geomorph.2006.09.005

6. **Zhang, W.**, J.H. Kang, and S.J. Lee. 2007. Visualization of saltating sand particle movement near a flat ground surface. *Journal of Visualization*, 10: 39-46. https://doi.org/10.1007/BF03181802

5. **Zhang, W.**, B.G. Paik, and S.J. Lee. 2007. PIV investigation of viscous flow in an exhaust hood of a LP steam turbine. *ASME Tran. Journal of Engineering for Gas Turbines and Power*, 129(3): 411-419.

4. **Zhang, W.**, and Daichin. 2006. Experimental study of flow structure behind a circular cylinder with wavy surface by PIV. *Journal of Hydrodynamics Series B*, 18 (1): 97.

3. **Zhang, W.**, Daichin, and S.J. Lee. 2005. PIV measurements of the near-wake behind a sinusoidal cylinder. *Experiments in Fluids*, 38 (6): 824-832. https://doi.org/10.1007/s00348-005-0981-9

2. **Zhang, W.**, Y. Wang, H. Zhang and Z. Xu. 2005. DPIV investigation of flow characteristics within the vaneless diffuser of a centrifugal blower. *Acta Aerodynamic Sinica*, 23(2): 144-151.

1. **Zhang, W.**, Y. Wang, H. Zhang and Z. Xu. 2002. Experimental investigation of vortex evolvement around a circular cylinder by digital particle image velocimetry (DPIV), *Acta Aerodynamic Sinica*, 20(4): 379-387.

PEER-REVIEWED CONFERENCE PAPERS

21. N. Goudarzi, O. Opadokun, W. Zhao, M. Usta, X. Liu, Q. Lin, **W. Zhang,** H. Richter, Y. Tao. 2023. Developing simulation-based coursework for energy sustainability modeling. *Energy and Sustainability.*

20. E. Shelley, E. Hubbard, **Zhang, W.** 2022. Comparison and Uncertainty Quantification of Roof Pressure using the NIST and TPU Aerodynamic Databases. *14th Americas Conference on Wind Engineering (14th ACWE).* Lubbock, Texas, May 17-19.

19. M. Wittlinger, S. Doherty, E. Shelley, **Zhang, W.** 2022. PIV Tests of Rooftop Vortices and Correlation with Peak Pressures Over a Low-Rise Building Model. *14th Americas Conference on Wind Engineering (14th ACWE).* Lubbock, Texas, May 17-19.

18. **Zhang, W.**, Y.P. Wu, C. Markfort. 2022. A Case Study of Wind Characteristics Affected by Terrain Features and Atmospheric Thermal Stability. *14th Americas Conference on Wind Engineering (14th ACWE).* Lubbock, Texas, May 17-19.

17. E. Shelley, E. Hubbard, **Zhang, W.** 2021. Critical Evaluation of Roof Pressure Statistics over an Isolated Low-rise Building using NIST and TPU Aerodynamic Databases. *6th American Association for Wind Engineering Workshop (online).* Clemson University, Clemson, SC, May 12-14.

16. E. Hubbard, E. Shelley, **Zhang, W.** 2021. Uncertainty Quantification of Wind-tunnel Tests of a Low-Rise Building Model using the NIST Aerodynamic Database. *6th American Association for Wind Engineering Workshop (online).* Clemson University, Clemson, SC, May 12-14.

15. R. Courtney, T. Stevens, L.H. Zhao, and **Zhang, W.** 2020. Flying Spiders: Effects of the length of a dragline and the spider mass in ballooning. *AIAA SciTech 2020 Proceeding.* 6–10 January, Orlando, Florida.

14. R. Ahlman, C. Flack, V. Shyam, and **Zhang, W.** 2020. Wake flow structure induced by a seal-whisker-inspired low-pressure turbine blade. *AIAA SciTech 2020 Proceeding.* 6–10 January, Orlando, Florida.

13. T. Stevens, R. Courtney, L.H. Zhao, L. Miller and **Zhang, W.** 2019. Flying Spiders: Effects of the length of a dragline and the spider mass in ballooning. *Proceedings of AJKFluids 2019.* 28 July–1 Aug., San Francisco.

12. A. Omilion, J. Turk and **Zhang, W.** 2018. Fractal grids for enhancing heat transfer: Effects of the fractal generation. *Proceeding of the 5th International Conference of Experimental Fluid Mechanics 2018.* 2–4 July, Munich, Germany.

11. J. Turk, S.J. Lee and **Zhang, W.** 2018. PIV analysis of wake induced by real-scale seal whiskers. *Proceeding of the 5th International Conference of Experimental Fluid Mechanics 2018.* 2–4 July, Munich, Germany.

10. J. Bunjavec and **Zhang, W.** 2018. PIV Analysis of wake structure of real Elephant Seal whiskers. *AIAA SciTech 2018 Proceeding.* 8–12 January, Kissimmee, Florida.

9. D. Pendleton and **Zhang, W.** 2017. Development of a new wind measurement system based on a hovering drone. *AIAA SciTech 2017 Proceeding.* 9–13 January, Grapevine, Texas.

8. A. Rinehart, V. Shyam, and **Zhang, W.** 2017. Wake structure induced by a seal whisker: effects of the cross-section inclination angle. *AIAA SciTech 2017 Proceeding*. 9–13 January, Grapevine, Texas.

7. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2015. Wind-tunnel experiments of turbulent flow over a surface-mounted 2-D block in a thermally-stratified boundary layer. *Proceeding of 33th Wind Energy Symposium (AIAA SciTech 2015)*. 5-9 January 2015. Kissimmee, Florida.

6. C.D. Markfort, **Zhang, W.**, and F. Porté-Agel. 2013. A canopy-type model for wind farm-atmosphere interaction. *Proceedings of the 2013 International Conference on Aerodynamics of Offshore Wind Energy Systems and Wakes*. DTU, Copenhagen, Denmark.

5. C.D. Markfort, E.L. Resseger, **Zhang, W.**, F. Porté-Agel and H.G. Stefan. 2012. Wind sheltering of small lakes by complex terrain. *Proceedings of the 20th Symposium on Boundary Layers and Turbulence, American Meteorological Society*. American Meteorological Society, Boston, Mass. Paper number 7.5.

4. Y.T. Wu, **Zhang, W.**, and F. Porté-Agel. 2010. Evaluation of dynamic subgrid-scale models in LES of turbulent boundary layer flow over 2-D topography. *5th International Symposium on Computational Wind Engineering (CWE2010)*. May 23-27, Chapel Hill, North Carolina, USA.

3. **Zhang, W.**, and P.P. Sarkar. 2010. Influence of surrounding buildings on the flow around a low-rise building in ABL and tornado-like winds. *5th International Symposium on Computational Wind Engineering (CWE2010)*. May 23-27, Chapel Hill, North Carolina, USA.

2. **Zhang, W.**, and P.P. Sarkar. 2009. Influence of surrounding buildings on tornado-induced wind loads of a low-rise building. *11th Americas Conferences on Wind Engineering*. June 22-26, San Juan, Puerto Rico, USA.

1. **Zhang, W.**, and P.P. Sarkar. 2008. Effects on ground roughness on tornado like vortex using PIV. *Proceedings of the AAWE workshop*. August 23-27, Vail, Colorado, USA.

BOOK CHAPTER

- **Wei Zhang**, Sang Joon Lee. 2009. "Recent experimental studies on the saltating sand particle transport and wind-sand interaction in saltation", Arid Environments and Wind Erosion (Nova Science Publishers, 2009), Edited by Antonio Fernandez-Bernal and Mauricio Alberto De La Rosa.

CONFERENCE ABSTRACTS

42. X. Liu, N. Goudarzi, **Zhang, W.**, W. Zhao, Q. Lin, M. Usta, Y. Tao. 2024. Using modeling and simulation to innovate engineering education: Development and implementation of new curriculum in sustainability energy systems. (Poster) *2024 Annual Meeting of Eastern Educational Research Association*. Clearwater, FL, Feb. 8-9, 2024.

41. **Zhang, W.**, E. Shelley, and H.X. Wu. 2023. Flow Structure of Rooftop Vortices over a Low-rise Building at High Reynolds Number. *76th Annual Meeting of the APS Division of Fluid Dynamics*. Washington D.C. Nov., 2023.

40. E. Shelley and **Zhang, W.** 2023. Bio-inspired Fractal Parapet to Mitigate Rooftop Suction over a Low-Rise Building in High Winds. *76th Annual Meeting of the APS Division of Fluid Dynamics*. Washington D.C. Nov., 2023.

39. Leo A Narbonne, Ervin P Urbanczyk, Corey Markfort and **Zhang, W.** 2023. Characterization of wind at Cedar Rapids, Iowa for wind resource assessment. *76th Annual Meeting of the APS Division of Fluid Dynamics*. Washington D.C. Nov., 2023

38. N. Zekaj, JJ. Kim, SJ Lee, and **Zhang, W.**. 2022. Vortex formation and flow separation on a scaled low-rise building model. *75th Annual Meeting of the APS Division of Fluid Dynamics*. 20-22 Nov., Indianapolis.

37. C. Coonrod, LH Zhao, **Zhang, W.**. 2022. Flying Spiders: Effects of the spider mass and the dragline length in spider landing. *75th Annual Meeting of the APS Division of Fluid Dynamics*. 20-22 Nov., Indianapolis.

36. E. Shelley, E. Hubbard, **Zhang, W.**. 2022. Comparison and uncertainty quantification of wind-tunnel measured roof pressure in the public aerodynamic databases. *7th Thermal and Fluids Engineering Conference*. Online Virtual and in Las Vegas, NV. May, 2022.

35. **Zhang, W.**, R. Ahlman, and C. Markfort. 2021. Effects of heterogeneous peri-urban landscape and thermal stability on wind profiles at Cedar Rapids, Iowa. *5-6th Thermal and Fluids Engineering Conference*. 26-28 May, New Orleans (Virtual).

34. **Zhang, W.**, R. Ahlman, Curtis Flack, and Vikram Shyam. 2021. Wake structure generated by a seal-whisker-inspired turbine blade. *5-6th Thermal and Fluids Engineering Conference*. 26-28 May, New Orleans (Virtual).

33. E. Shelley, E. Hubbard, **Zhang, W.** 2021. Critical Evaluation of Roof Pressure Statistics over an Isolated TTU Building using NIST and TPU Aerodynamic Database. *6th American Association for Wind Engineering Workshop (online)*. Clemson, SC, May 12-14.

32. E. Hubbard, E. Shelley, **Zhang, W.** 2021. Uncertainty Quantification of Wind-tunnel Tests of a Low-Rise Building Model using the NIST Aerodynamic Database. *6th American Association for Wind Engineering Workshop (online)*. Clemson, SC, May 12-14.

31. R. Ahlman, **Zhang, W.**, and C. Markfort. 2020. Effects of heterogeneous peri-urban landscape and thermal stability on wind profiles at Cedar Rapids, Iowa. *73rd Annual Meeting of the APS Division of Fluid Dynamics*. 22-24 Nov., Chicago.

30. E. Shelley, **Zhang, W.**. 2020. Numerical simulation of surface pressure coefficient Over a low-rise building in strong winds. *73rd Annual Meeting of the APS Division of Fluid Dynamics*. 22-24 Nov., Chicago.

29. R. Ahlman, C. Markfort, and **Zhang, W.** 2019. Land cover effects on wind profiles: Case study at Kirkwood, Iowa. *72nd Annual Meeting of the APS Division of Fluid Dynamics*. 23-26 Nov., Seattle.

28. **Zhang, W.**, R. Ahlman, C. Flack and V. Shyam 2019. Turbulent wake generated by a seal-whisker-inspired turbine blade. *72nd Annual Meeting of the APS Division of Fluid Dynamics*. 23-26 Nov., Seattle.

27. T. Stevens, J. Turk, L.H. Zhao and **Zhang, W.** 2018. Flying Spiders: Effects of the length of a dragline and the spider mass in ballooning. *71st Annual Meeting of the APS Division of Fluid Dynamics*. 18-20 Nov., Atlanta.

26. A. Omilion, J. Turk, and **Zhang, W.** 2018. Effectiveness of Fractal Square Grids to Enhance Turbulence: Proper Orthogonal Decomposition Analysis. *71st Annual Meeting of the APS Division of Fluid Dynamics*. 18-20 Nov., Atlanta.

25. J. Turk, **Zhang, W.** and S.J. Lee 2018. Vortex Shedding behind a Seal Whisker and Vortex-Induced Vibration. *71st Annual Meeting of the APS Division of Fluid Dynamics*. 18-20 Nov., Atlanta.

24. J. Turk and **Zhang, W.** 2018. PIV analysis of vortex shedding and vortex-induced vibration. *3rd Annual Nature-inspired Exploration Summit. Biocene 2018*. 14-17 August, Cleveland.

23. C.D. Markfort, **Zhang, W.**, and F. Porté-Agel. 2018. Measurements of turbulent boundary layer flow and surface fluxes over roughness and temperature transitions. *23rd Boundary-layer Turbulence Symposium*. 12-16 June, Oklahoma City.

22. J. Turk, J. Bunjevac, S.J. Lee and **Zhang, W.** 2017. PIV analysis of wake induced by real-scale seal whiskers. *70th Annual Meeting of the APS Division of Fluid Dynamics*. 19-21 Nov., Denver.

21. A. Omilion, M. Ibrahim, and **Zhang, W.** 2017. Fractal grids for enhancing heat transfer: Effects of the number of fractal scales. *70th Annual Meeting of the APS Division of Fluid Dynamics*. 19-21 Nov., Denver.

20. J. Turk and **Zhang, W.** 2017. Vortex Shedding by a Real Elephant Seal Whisker. *2nd NIEA Biomimicry Summit*. 2–4 October, OAI-NASA, Cleveland.

19. J. Turk, J. Bunjevac, and **Zhang, W.** 2017. PIV analysis of wake induced by real-scale seal whiskers. *11th International Symposium for Particle Image Velocimetry*. 19-21 June, Busan Korea.

18. C.D. Markfort, **Zhang, W.**, and and F. Porté-Agel. 2016. Measurements of turbulent boundary layer flow and surface fluxes over roughness and temperature transitions. *AGU Fall meeting 2016*. 12-16 December, San Francisco.

17. A. Rinehart, V. Shyam, and **Zhang, W.** 2016. How do seal whiskers suppress vortex shedding. *69th Annual Meeting of the APS Division of Fluid Dynamics*. 20-22 Nov., Portland.

16. J. Bunjevac, A. Rinehart, and **Zhang, W.** 2016. PIV Analysis of wake induced by real harbor seal whiskers. *69th Annual Meeting of the APS Division of Fluid Dynamics*. 20-22 Nov., Portland.

15. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2016. Surface fluxes in atmospheric boundary layer flows over complex terrain. *69th Annual Meeting of the APS Division of Fluid Dynamics*. 20-22 Nov., Portland.

14. C.D. Markfort, **Zhang, W.** and F. Porté-Agel. 2016. Measurements of turbulent boundary layer flow and surface fluxes over roughness and temperature transitions. *69th Annual Meeting of the APS Division of Fluid Dynamics*. 20-22 Nov., Portland.

13. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2016. Wind-tunnel experiments of turbulent wake flows induced by steep topography in thermally-stratified boundary layers. *AMS BLT Symposium 2016*. 20-24 June, Salt Lake City, Utah.

12. C.D. Markfort, **Zhang, W.** and F. Porté-Agel. 2016. A simple model for average kinetic energy flux within large wind turbine arrays. *AMS BLT Symposium 2016*. 20-24 June, Salt Lake City, Utah.

11. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2015. Turbulent flows over a modeled steep topography in a thermally-stratified boundary layer. *68th Annual Meeting of the APS Division of Fluid Dynamics*. 22-24 November, Boston.

10. S. McClure, S.J. Lee and **Zhang, W.**. 2015. Flow around new wind fence with multi-scale fractal structure in an atmospheric boundary layer. *68th Annual Meeting of the APS Division of Fluid Dynamics*. 22-24 November, Boston.

9. C.D. Markfort, **Zhang, W.** and F. Porté-Agel. 2015. A simple model for average kinetic energy flux within large wind turbine arrays. *68th Annual Meeting of the APS Division of Fluid Dynamics*. 22-24 November, Boston.

8. J. Wolf and **Zhang, W**. 2015. Visualization of Air Particle Dynamics in an Engine Inertial Particle Separator. *68th Annual Meeting of the APS Division of Fluid Dynamics*. 22-24 November, Boston.

7. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2015. Wind-tunnel experiments of turbulent flow over a surface-mounted 2-D block in a thermally-stratified boundary layer. *67th Annual Meeting of the APS Division of Fluid Dynamics*. 23-25 November, San Francisco.

6. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2014. Effects of land-surface heterogeneity on turbulent transport of momentum and heat: wind-tunnel studies. *21st Symposium on Boundary Layers and Turbulence*. 9-13 June, Leeds, United Kingdom.

5. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2013. Turbulent flow over a surface-mounted 2-D block in thermally-stratified boundary layers. *AGU 2013 Fall Meeting*. 9-13 Dec., San Francisco, California.

4. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2013. An integrated approach for the study of wind turbine and atmospheric boundary layer interaction. *North American Wind Energy Academy (NAWEA) 2013 Symposium*. 6-8 August, UC Boulder, Colorado.

3. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2013. Wind-tunnel experiments of the interaction between atmospheric boundary layer flow and wind turbines. *IEA Task 31WAKEBENCH Colloquium*. June, DTU, Copenhagen, Denmark.

2. C.D. Markfort, **Zhang, W.**, F. Porté-Agel. 2013. An analytical canopy-type model for wind farm-atmosphere interaction. *International Conference on Aerodynamics of Offshore Wind Energy Systems and Wakes*. June,DTU, Copenhagen, Denmark.

1. **Zhang, W.**, C.D. Markfort, and F. Porté-Agel. 2013. Turbulent flow over a surface-mounted 2-D block: thermal stability effects. *European Geosciences Union General Assembly* April 07-12, 2013, Vienna, Austria.

INVITED TALKS

13. Particle Image Velocimetry (PIV) application to wind engineering research, NEHRI experimental facility workshop, Florida International University, Miami, 08/23

12. Unravel complex flow physics to achieve wind sustainability and resilience, Case Western Reserve University, Cleveland, 02/23

11. Unravel complex flow physics to achieve wind resilience and sustainability, Texas Tech University, Lubbock, 12/22

10. Achieve Wind Resilience and Sustainability by Bio-inspiration and Biomimicry, ASCE Bio-inspired Structures Committee Meeting, online, 06/21

9. Fluid Mechanics in Extreme Wind Storms, CSU ME Graduate Seminar Series, Cleveland, 10/20

8. Two Faces of Wind, CSU ME Graduate Seminar Series, Cleveland, 09/19

7. Wind Energy: Past, present and future, CSU Choose Ohio First and NSF S-STEM Seminar Series, Cleveland, 11/18

6. Wind-resilient buildings and structures: What can we learn from Nature, Ohio Aerospace Institute, Biocene 2018, Cleveland, 08/18

5. Smart flow control inspired by Nature, Cleveland Clinic Lerner Research Institute, Cleveland, 04/18

4. Bio-inspired smart flow control, Biomimicry Science and Research Center, University of Akron, Akron, 02/18

3. How seal whiskers suppress vortex shedding: effects of the plane inclination angle, the First Biomimicry Symposium and Education Summit, OAI, Cleveland, 08/16

2. Bio-inspired flow control strategy, School of Architecture, Civil and Environment. École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, 07/16

1. Interaction of atmospheric boundary layer with wind turbine wakes, NASA Glenn Research Center, Cleveland 10/14

COURSES TAUGHT

- Fall 2018, Fall 2019, Fall 2021: **MCE 430/530 Applied Fluid Mechanics**
  Cross-listed upper-level undergraduate and graduate course, covering conservation equations, differential and integral analysis methods, laminar and turbulent flows, internal and external flows, incompressible and compressible flows. It is offered every year (in the Fall semester). Four credit hours. Enrollment 35, 41, 23.

- Spring 2020: **MCE 610/710 Numerical Heat Transfer and Computational Fluid Flow**
  Upper-level graduate course, covering conservation equations and uniform format, discretization of computational domain and governing equations, numerical methods for solving diffusion

equation, discretized schemes of diffusion and convection equations, primitive variable methods for elliptic flow & heat transfer, and turbulence modeling. Four credit hours. Enrollment 10.

- Spring 2018, Spring 2019: **ESC 301 Introduction to Fluid Mechanics**
  Introductory level fluid mechanics course, covering fluid definition, fluid statics, Integral and differential analysis of fluid motion, Bernoulli equation, dimensional analysis and internal/external flows. Three credit hours. Enrollment 16 and 56.

- Fall 2017, Fall 2020: **MCE 638/738 Viscous Flow I**
  Upper-level graduate course, covering conservation equations, analytical solutions of the Navie-Stokes equations, differential and integral analysis methods, laminar and turbulent flows, boundary-layer theory, incompressible and compressible flows. It is offered every other year (in the Fall semester). Four credit hours. Enrollment 9.

- Spring 2016, Spring 2021: **MCE 639/739 Viscous Flow II**
  Upper-level graduate course, covering laminar and turbulent flows, boundary-layer theory, incompressible/compressible flows. It is offered every other year (in the Spring semester). Four credit hours. Enrollment 10.

- Fall 2016: **MCE 641/741 Convection Heat Transfer**
  Upper-level graduate course with the prerequisite of viscous flow I and II; external/internal momentum/heat transport. Four credit hours. Enrollment 6.

- Spring 2015: **MCE 421/521 Applied Thermodynamics**
  Cross-listed undergraduate/graduate course, power cycles and refrigeration cycle processes; Analyze the efficiency of power and refrigeration cycles, HVAC components. Three or Four credit hours. Enrollment 60.

- Spring 2015: **MCE 481 Applied Thermodynamics Lab**
  Labs for the undergraduate level course MCE 421. Enrollment 38.

- Fall 2014 – 2023: **MCE 483 Thermal Systems Lab**
  One of the two ME senior laboratory electives, composed of eight lab modules covering fluid mechanics, heat transfer and applied thermodynamics. It is offered in every fall semester. Three credit hours. Enrollment: 9, 22, 27, 18, 24, 7 and 8.

TEACHING DEVELOPMENT

- Teach students how to learn (4 online zoom meetings, Spring 2022)
- Enter Mentoring Training (5-day on-line training, Spring 2021)
- Flipping Your Remote Classroom (Summer 2020)
- Gateway Courses Faculty Learning Community on Applying psychological sciences to teaching and learning to improve student success (Five 90-min sessions, Spring 2019)
- Provost's Teaching Summit (2017, 2018, 2019, 2020, 2021)
- Seminar Series organized by the Center for Teaching Excellence (2015 – present)