Shyuan (Jeffrey) Cheng

Department of Mechanical Science & Engineering (MechSE)
University of Illinois at Urbana-Champaign (UIUC)

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Education

National Chung Kung University	International Degree of Energy Engineering	B.S., 2016
Seoul National University	Energy Resource Enegineering	Exchange, 2016
University of Illinois at Urbana-Champaign	Mechanical Science and Engineering	M.S., 2019
University of Illinois at Urbana-Champaign	Mechanical Science and Engineering	Ph.D., 2024

Dissertation Title: Exploring the Dynamics of Fluid-Structure Interaction: From Single Structures to Complex Environmental Systems
Graduate Advisor: Leonardo P. Chamorro (M.S. & Ph.D., UIUC)

Academic Experience

Graduate Research Assistant, University of Illinois at Urbana-Champaign *Urbana, IL, 2017 - present*
Renewable Energy & Turbulent Environment Group
– Wind energy: offshore platform oscillation, pressure gradient effect, complex topography effect
– Complex fluid-structure interaction: flexible perforated structure, interaction under stratified turbulence
– Turbulence: boundary layer transition, clay-water mixture turbulence, turbulent characteristic of tidal flow

Undergraduate Research Assistant, Seoul National University *South Korea, March/2016 - September/2016*
Artificial Intelligence Robotics Lab
– Developed stack autoencoder algorithm for image recognition to filter noise and recover destroyed image.

Intern Engineer, National Space Organization *Taiwan, June/2015 - September/2015*
Propulsion Lab
– Designed a thrust measurement device for propulsion system on satellite.
– Performed stress and thruster flow field analysis using Comsol.

Teaching Experience

Guest Speaker, University of Illinois Online program *Spring 2023*
– Introduction to imaging principle

Invited Lecturer, GEC Academy Summer School *Summer 2022*
– Introduction of urban heating effect

Graduate Teaching Assistant, MechSE UIUC *2017-2023*
– Turbulence, Viscous flow, Experimental fluid mechanics, Fundamental of fluid dynamics, Heat transfer

Teaching certificate program, UIUC *Fall 2017 & Spring 2018*

Advising Experience

Mentor for Illinois Scholars Undergraduate Research (ISUR) Program *2022 & 2023*
Undergraduate student: Avi Distler, Andrew Klingberg, James Esguerra, Dave Marshall, John Venetos, Nirvan Sinha
– 2022 Project: Surgical mask- a direct source for inhalation of microplastics
– 2023 Project: The effect of the boundary layer characteristic on the accelerating/decelerating wall.

Mentor, Project Tyra Graduate School Application Program *2022 & 2023*
– Provide feedback and revision for 4 graduate school applications

Award & achievements

James O. Smith Memorial Outstanding TA Award *2023*

Taiwan Engineering Graduate School Scholarship Program Winner *2021 & 2022*
– Topic title: A novel wind turbine design and its potential on dense wind farms

Grainger Engineering Travel Award *2021 & 2022*
– 2022 presentation: Effect of a single gap on the dynamics of flexible plates
– 2021 presentation: Pressure gradient effects on the wake of a model wind turbine in a turbulent boundary layer

NCKU Exchange Scholarship Winner *2016*

NCKU Outstanding Student for Academic Achievement *2014 - 2016*
– Top 3 highest academic standing within department

Service

Reviewer *2020-2024*
– *Ocean Engineering*, 3 reviews in 2024
– *Physics of Fluids*, 10 reviews since 2022
– *Journal of Energy Engineering*, 2 reviews since 2022
– *Journal of Renewable and Sustainable Energy*, 5 reviews since 2020

Publications (29 peer-reviewed journal articles, 13 first/co-first author)

[29] Cheng, S.*, Neary, V. S., & Chamorro, L. P. (2024). On detrending stream velocity time series for robust tidal flow turbulence characterization. **Ocean Eng**, 300, 117427.
[28] Kim, J. T., Yoon, H. J., Cheng, S.*, Liu, F., Kang, S., Paudel, S., Chamorro, L. P., & Rogers, J. A. (2024). Functional bio-inspired hybrid fliers with separated ring and leading edge vortices. **PNAS Nexus**, p110.
[27] Nguyen, D., Kesler, R. M., Cheng, S., Chamorro, L.P., Vega, S., Fields, A., & Masoud, F. (2024). On the Fire Hose Kickback Force in Solid Water Streams. **Fire Technol**, 1-15.
[26] Kang, S., Hong, L., Cheng, S., Best, J. L., & Chamorro, L. P. (2023). On the settling of aligned spherical particles in various quiescent media. **J Fluid Mech**, 975, R1.
[25] Cheng, S.* Olivieri, S., Rosti, M. E., & Chamorro, L. P. (2023). Gap-modulated dynamics of flexible plates. **J Fluid Mech**, 974, A12.
[24] Siguenza-Alvarado, D., Pulletikurthi, V., Quinones, J. J., Nelson, C., Cheng, S., Doosttalab, A., Chamorro L. P. & Castillo, L. (2023). Wake interaction of aligned wind turbines over two-dimensional hills. **Phys Fluids**, 35(10).
[23] Prada, A. F., Distler, A., Cheng, S., Scott, J. W., Chamorro, L. P., Subramanian, G., Verma V. & Turner, A. (2023). Disposable face masks: a direct source for inhalation of microplastics. **arXiv**:2308.16295.
[22] Pulletikurthi, V., Esquivel-Puentes, H. A., Cheng, S., Chamorro, L. P., & Castillo, L. (2023). Impact of flow regime on the performance of anti-biofouling coatings. **Sci Rep**, 13(1), 9501.
[21] Kang, S., Cheng, S., Hong, L., Kim, J. T., & Chamorro, L. P. (2023). Single sidewall cooling modulation on Rayleigh–Bénard convection. **J Fluid Mech**, 957, A13.
[20] Hong, L., Cheng, S.*, Houseago, R. C., Parsons, D. R., Best, J. L., & Chamorro, L. P. (2022). On the submerged low-Cauchy-number canopy dynamics under unidirectional flows. **J Fluids Struct**, 113, 103646.
[19] Cheng, S.* Kaufman, S., Tipnis, V., Best, J. L., & Chamorro, L. P. (2022). Effects of low clay concentrations on nearly isotropic turbulence. **Phys Rev Fluids**, 7(7), 073801.
[18] Yoon, H. J., Lee, G., Kim, J. T., Yoo, Cheng, S., ... & Rogers, J. A. (2022). Biodegradable, three-dimensional colorimetric fliers for environmental monitoring. **Sci Adv**, 8(51), eade3201.
[17] Evans, H. B., Doosttalab, A., Siguenza, D., Cheng, S., Chamorro, L. P., & Castillo, L. (2022). Spectral features of the wake and power fluctuations of model wind turbines under low-level jets. **J Renew Sustain Energy**, 14(3).
[16] Jin, Y., Cheng, S., & Chamorro, L. P. (2022). On the impact of layout in the dynamics of wind turbine arrays under passive oscillations. **J Renew Sustain Energy**, 14(3).
[15] Zhang, B., Jin, Y., Cheng, S., Zheng, Y., & Chamorro, L. P. (2022). On the dynamics of a model wind turbine under passive tower oscillations. **Appl Energy**, 311, 118608.
[14] Yuk, J., Chakraborty, A., Cheng, S., Chung, C. I., Jorgensen, A., Basu, S., Chamorro, L. & Jung, S. (2022). On the design of particle filters inspired by animal noses. **J R Soc Interface**, 19(188), 20210849.
[13] Houseago, R. C., Hong, L., Cheng, S., Best, J. L., Parsons, D. R., & Chamorro, L. P. (2022). On the turbulence dynamics induced by a surrogate seagrass canopy. **J Fluid Mech**, 934, A17.
[12] Cheng, S.* Elgendi, M., Lu, F., & Chamorro, L. P. (2021). On the wind turbine wake and forest terrain interaction. **Energies**, 14(21), 7204.
[11] Cai, T., Cheng, S.* Segalini, A., & Chamorro, L. P. (2021). Local topography-induced pressure gradient effects on the wake and power output of a model wind turbine. **Theor Appl Mech Lett**, 11(5), 100297.
[10] Siguenza, D., Doosttalab, A., Cheng, S., ... & Castillo, L. (2021). Exploring the effects of low-level-jets on the energy entrainment of vertical-axis wind turbines. **J Renew Sustain Energy**, 13(3).
[9] Cai, T., Kim, J. T., Cheng, S., Ma, F., & Chamorro, L. P. (2021). On the effect of orifice thickness and divergence angle in the near and intermediate fields of axisymmetric jets. **Exp Therm Fluid Sci**, 123, 110293.
[8] Cheng, S.* Kim, G., Hong, L., Kim, J. T., Li, K. C., & Chamorro, L. P. (2021). On the acoustic fountain types and flow induced with focused ultrasound. **J Fluid Mech**, 909, R2.
[7] Cheng, S.* Chamorro, L. P., & Ansell, P. J. (2021). On the H-type transition to turbulence—Laboratory experiments and reduced-order modeling. **Phys Fluids**, 33(2).
[6] Zhang, B., Cheng, S.* Lu, F., Zheng, Y., & Chamorro, L. P. (2020). Impact of topographic steps in the wake and power of a wind turbine: Part a—statistics. **Energies**, 13(23), 6411.
[5] Aydin, O., Emon, B., Cheng, S., ... & Saif, M. T. A. (2020). Performance of fabrics for home-made masks against the spread of COVID-19 through droplets: A quantitative mechanistic study. **Extreme Mech Lett**, 40, 100924.
[4] Jin, Y., Kim, J. T., Cheng, S., Barry, O., & Chamorro, L. P. (2020). On the distinct drag, reconfiguration and wake of perforated structures. **J Fluid Mech**, 890, A1.
[3] Cheng, S.* Jin, Y., & Chamorro, L. P. (2020). Wind turbines with truncated blades may be a possibility for dense wind farms. **Energies**, 13(7), 1810.
[2] Cheng, S.* Jin, Y., & Chamorro, L. P. (2020). On the multiscale oscillations of a hinged plate under stratified coherent motions. **J Fluids Struct**, 94, 102944.
[1] Jin, Y., Cheng, S., & Chamorro, L. P. (2019). Active pitching of short splitters past a cylinder. **Phys Rev E**, 063106.

Submitted

[3] Cheng, S.* Jetti, Y. S., Neary, V.S., Ostoja-Starzewskil, M. & Chamorro, L. P. (2024). Incorporating long-range dependence and fractal features in turbulence spectra. **PNAS**
[2] Jetti, Y. S., Cheng, S., Chamorro, L. P. & Ostoja-Starzewskil, M. (2024). A covariance function with fractal, Hurst, and scale-bridging effects for random surfaces and turbulence **Proc A**
[1] Wang, Y., Cheng, S., Chamorro, L. P., & Chen, J. (2024). Breakdown of isotropic turbulence induced by non-inertial effects. **J Fluid Mech**

Conference Presentations (31 co-authored conference talks)

[31] Cheng, S.* Olivieri, S., Rosti, M. E., & Chamorro, L. On the distinct drag and wake of flexible plates with a single perforation. *76th APS DFD Meeting*, Washington DC, 2023.
[30] Cheng, S.* Chamorro, L., & Neary, V. On detrending stream velocity time series for robust riverine flow turbulence characterization. *76th APS DFD Meeting*, Washington DC, 2023.
[29] Kang, S., Hong, L., Cheng, S., Best, J., & Chamorro, L. P. Settling dynamics of vertically aligned particles in single and two-layer fluid media. *76th APS DFD Meeting*, Washington DC, 2023.
[28] Van Zante, Z., Purwar, T., Quinones, J., Kang, S., Cheng, S., Chamorro L. P. & Castillo, L. (2023). A Novel and Versatile Cough Simulator for Respiratory Disease Studies. *76th APS DFD Meeting*, Washington DC, 2023.
[27] Wang, Y., Chen, J., Cheng, S., & Chamorro, L. Rotating Effects on Energy Transfer Mechanism of Isotropic Turbulence. *76th APS DFD Meeting*, Washington DC, 2023.
[26] Purwar, T., Van Zante, Z., Cheng, S., Chamorro, L., Aksak, B., Castano, V., & Castillo, L. Resilient and Scalable Bio-Inspired Metamaterial for Passive Noise Control. *76th APS DFD Meeting*, Washington DC, 2023.
[25] Cheng, S.*, Olivieri, S., Rosti, M., & Chamorro, L. Effect of a single gap on the dynamics of flexible plates. *75th APS DFD Meeting*, Indianapolis, IN, 2022.
[24] Purwar, T., Cheng, S., Van Zante, Z., Chamorro, L., Aksak, B., Castano, V., & Castillo, L. Resilient and Scalable Quasicrystal Coatings for Quiet and Efficient Urban Air Mobility. *75th APS DFD Meeting*, Indianapolis, IN, 2022.
[23] Jung, H., Cheng, S., & Chamorro, L. Boundary layer structure over standing waves. *75th APS DFD Meeting*, Indianapolis, IN, 2022.
[22] Kang, S., Hong, L., Cheng, S., Kieffer, S., Best, J., & Chamorro, L. Interaction of inertial particles falling in a quiescent, density-stratified, two-layer medium. *75th APS DFD Meeting*, Indianapolis, IN, 2022.
[21] Pulletikurthi, V., Cheng, S., Wilker, J., Chamorro, L., & Castillo, L. The potential of bio-inspired structures on anti-biofouling. *75th APS DFD Meeting*, Indianapolis, IN, 2022.
[20] Moser, A., Esquivel-Puentes, A., Van Zante, Z., Francioso, V., Johnson, O., Nelson, C., Cheng, S., & Castillo, L. Experimental Study of CO 2 Capture in a Model Wind Turbine Array. *75th APS DFD Meeting*, Indianapolis, IN, 2022.
[19] Chamorro, L., Kang, S., Cheng, S., Hong, L., & Kim, J. T. Effect of a single sidewall cooling on Rayleigh-Bénard convection. *75th APS DFD Meeting*, Indianapolis, IN, 2022.
[18] Siguenza, D., Esquivel-Puentes, A., Appiah, R., Quinones, J., Cheng, S., Chamorro, L., & Castillo, L. Winglet size effect on the wake dynamics of model wind turbines. *75th APS DFD Meeting*, Indianapolis, IN, 2022.
[17] Bardoel, S. L., Cheng, S., Chamorro, L. P., & Fernando, H. J. Fog Formation during the Interaction of a Gravity Current with Coastal Topography. *102nd American Meteorological Society Meeting*, Houston, TX, 2022.
[16] Wing, L., Troolin, D., Cheng, S., Sun, J., & Chamorro, L. On the unsteady dynamics of synthetic leaves: Laboratory experiments using synchronized PIV and DIC. *14th International Symposium on PIV*, August, 2021.
[15] Cheng, S.* Cai, T., Segalini, A., & Chamorro, L. Pressure gradient effects on the wake of a model wind turbine in a turbulent boundary layer. *74th APS DFD Meeting*, Pheonix, AZ, 2021.
[14] Cheng, S.* Chamorro, L., Kim, G., & Li, K. On the generation of steady fountains by high intensity focused ultrasonic: flow field and simple formulation. *74th APS DFD Meeting*, Pheonix, AZ, 2021.
[13] Kang, S., Hong, L., Cheng, S., & Chamorro, L. Rayleigh-Bénard-like convection with an asymmetric vertical cooling. *74th APS DFD Meeting*, Pheonix, AZ, 2021.
[12] Bocanegra Evans, H., Doosttalab, A., Siguenza, D., Cheng, S., Chamorro, L., & Castillo, L. Spectral inspection of the wake and power fluctuations of wind turbines under low-level jets: an experimental study. *74th APS DFD Meeting*, Pheonix, AZ, 2021.
[11] Siguenza, D., Pulletikurthi, V., Odonnell, J., Nelson, C., Quinones, J., Cheng, S. & Castillo, L. An Experimental Survey on the Interaction of Wind Turbines over Complex Terrain. *74th APS DFD Meeting*, Pheonix, AZ, 2021.
[10] Diab, M. J., Cheng, S., Yuk, J., Chung, C. I., Jorgensen, A., Chamorro, L., & Chakraborty, A. Design of new-generation scalable filters with tortuous pathways inspired from animal noses. *74th APS DFD Meeting*, Pheonix, AZ, 2021.
[9] Kaufman, S., Tipnis, V., Best, J., Chamorro, L. P., & Cheng, S. Quantifying the dynamics of transitional clay flows using a novel experimental approach. *AGU Fall Meeting*, Chicago, IL, 2020.
[8] Lai, W., Troolin, D., Jiao, S., Cheng, S., & Chamorro, L. On the fluid-structure interaction of synthetic leaves. *73rd APS DFD Meeting*, 2020.
[7] Dutta, S., Cheng, S., Parikh, A., Truscott, T., Fischer, P., & Chamorro, L. On turbulence and particle transport in closed rooms. *73rd APS DFD Meeting*, 2020.
[6] Kaufman, S., Tipnis, V., Best, J., Chamorro, L., Cheng, S., Sen, S., & Ewoldt, R. Quantifying the dynamics of transitional clay flows within nearly isotropic turbulence. *73rd APS DFD Meeting*, 2020.
[5] Zekry, D., Cheng, S., Chamorro, L., & Wissa, A. Towards Mission Adaptability of Small UAVs: A Leading-Edge Alula-Inspired Device (LEAD). *73rd APS DFD Meeting*, 2020.
[4] Siguenza, D., Doosttalab, A., Cheng, S., Bocanegra-Evans, H., Chamorro, L. P., & Castillo, L. Exploring the Effects of Low-Level-Jet Velocity Profiles on the Energy Entrainment of Vertical-Axis Wind Turbines. *73rd APS DFD Meeting*, 2020.
[3] Doosttalab, A., Bocanegra Evans, H., Siguenza-Alvarado, D., Cheng, S., Chamorro, L., & Castillo, L. Spectral analysis of flow, wind turbine and wake interaction in low-level jet conditions. *73rd APS DFD Meeting*, 2020.
[2] Cheng, S.* Jin, Y., & Chamorro, L. P. On the multiscale oscillations of a hinged plate under stratified turbulence.*72nd APS DFD Meeting*, Seattle, WA, 2019.
[1] Jin, Y., Cheng, S., & Chamorro, L. P. Fluttering, twisting and orbital motions of wall-mounted flexible plates. *72nd APS DFD Meeting*, Seattle, WA, 2019.