

CHANG LIU

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ACADEMIC EMPLOYMENT

University of Connecticut

8/2023 - now

Assistant Professor of Department of Mechanical Engineering

University of California, Berkeley

8/2021 - 7/2023

Postdoctoral Scholar in Department of Physics (Advisor: Edgar Knobloch, Collaborator: Keith Julien)

EDUCATION

Johns Hopkins University

8/2017 - 8/2021

Ph.D. in Mechanical Engineering (Advisor: Dennice F. Gayme)

8/2021

Dissertation title: Feedback interconnection based input-output analysis of spatio-temporal response in wall-bounded shear flows (committees: C. P. Caulfield, C. Meneveau and D. F. Gayme)

M.S.E. in Applied Mathematics and Statistics

5/2021

M.S.E. in Mechanical Engineering

8/2020

Shanghai Jiao Tong University

9/2013 - 7/2017

B.E. in Naval Architecture and Ocean Engineering (Advisor: Shixiao Fu) (Top 1% thesis award)

B.E. in Computer Technology and its Application (Advisor: Minyi Guo)

AWARDS AND HONORS

BPA Professional Development Award (\$1250)

2023

Corrsin-Kovasznyai Outstanding Paper Award (\$500)

2021

Creel Family Teaching Assistant Award (\$500)

2019

Outstanding Contribution Award of Chun-Tsung Foundation

2018

Top 1% Bachelor Thesis in Shanghai Jiao Tong University

2017

Hongyi Scholarship (¥25,000)

2016

Fan, Xuji Scholarship (¥10,000 per year)

2015

National Scholarship (¥8000)

2014

FUNDING SUPPORT

F1. NSF ACCESS Explore PHY230056 “Role of domain geometry in two-dimensional fluid flows: from turbulence in anisotropic domains to inclined porous medium convection” (Co-PI) 200K CPU Hours
04/2023 - 04/2024

JOURNAL ARTICLES

*: corresponding author, ____: research mentee

J1. C. Liu*, M. Sharma, K. Julien, E. Knobloch (2023) “Fixed-flux Rayleigh-Bénard convection in doubly periodic domains” *Journal of Fluid Mechanics* (Under Review)

J2. Y. Shuai*, C. Liu, D. F. Gayme (2023) “Structured input-output analysis of oblique laminar-turbulent patterns in plane Couette-Poiseuille flow” *International Journal of Heat and Fluid Flow* 103, 109207 (Invited)

J3. X. Fu, S. Fu*, C. Liu, M. Zhang (2023) “Data-driven approach for modelling Reynolds stress tensor with invariance preservation” *Computers & Fluids* (Under Review)

- J4. **C. Liu***, A. D. Clark (2023) “Analysing the impact of bottom friction on shallow water waves over idealised bottom topographies” *Geophysical & Astrophysical Fluid Dynamics* 117(2), 107-129
- J5. **C. Liu***, A. D. Clark (2023) “Semi-analytical solutions of shallow water waves with idealized bottom topographies” *Geophysical & Astrophysical Fluid Dynamics* 117(1), 35-58
- J6. **C. Liu***, K. Julien & E. Knobloch (2022) “Staircase solutions and stability in vertically confined salt-finger convection” *Journal of Fluid Mechanics* 952, A4
- J7. **C. Liu*** & E. Knobloch* (2022) “Single-mode solutions for convection and double-diffusive convection in porous medium” *Fluids* 7(12), 373 (Invited, Issue Cover)
- J8. **C. Liu***, C. P. Caulfield, D. F. Gayme (2022) “Structured input-output analysis of stably stratified plane Couette flow” *Journal of Fluid Mechanics* 948, A10
- J9. **C. Liu***, I. Gluzman, M. Lozier, S. Midya, S. Gordeyev, F. O. Thomas, D. F. Gayme (2022) “Spatial input-output analysis of actuated turbulent boundary layers” *AIAA Journal* 60(10), 6313-6327
- J10. **C. Liu***, D. F. Gayme (2021) “Structured input-output analysis of transitional wall-bounded flows” *Journal of Fluid Mechanics* 927, A25 (Corrsin-Kovasznay Outstanding Paper Award)
- J11. M. Zhang, S. Fu* **C. Liu**, H. Ren, Y. Xu* (2021) “Experimental Investigation on Vortex-induced Force of a Steel Catenary Riser under in-plane vessel motion” *Marine Structures* 78, 102882
- J12. **C. Liu**, D. F. Gayme* (2020) “An input-output based analysis of convective velocity in turbulent channels” *Journal of Fluid Mechanics* 888, A32
- J13. **C. Liu***, D. F. Gayme* (2020) “Input-output inspired method for permissible perturbation amplitude of transitional wall-bounded shear flows” *Physical Review E* 102, 063108
- J14. **C. Liu**, S. Fu*, M. Zhang*, H. Ren, Y. Xu (2020) “Hydrodynamics of a flexible cylinder under modulated vortex-induced vibrations” *Journal of Fluids and Structures* 94, 102913
- J15. H. Ren, S. Fu*, **C. Liu**, M. Zhang, Y. Xu, S. Deng (2020) “Hydrodynamic Forces of a Semi-submerged Cylinder in an Oscillatory Flow” *Applied Sciences* 10(18), 6404
- J16. H. Ren, M. Zhang*, J. Cheng, P. Cao, Y. Xu, S. Fu, **C. Liu**, Y. Wang (2020) “Magnification of Hydrodynamic Coefficients on a Flexible Pipe Fitted with Helical Strakes in Oscillatory Flows” *Ocean Engineering* 210, 107543
- J17. H. Ren, M. Zhang*, J. Cheng, P. Cao, Y. Xu, S. Fu, **C. Liu** (2020) “Experimental Investigation on Vortex-induced Vibration of a Flexible Pipe under Higher Mode in an Oscillatory Flow” *Journal of Marine Science and Engineering* 8(6), 408
- J18. J. Wang, S. Fu*, R. Baarholm, M. Zhang, **C. Liu** (2019) “Global motion reconstruction of a steel catenary riser under vessel motion” *Ship and Offshore Structures* 14(5), 442-456
- J19. **C. Liu***, L. Dong (2019) “Stabilization of Lagrange points in circular restricted three-body problem: a port Hamiltonian approach” *Physics Letters A* 383, 1907-1914
- J20. **C. Liu***, L. Dong (2019) “Physics-based control education: energy, dissipation and structure assignments” *European Journal of Physics* 40(3), 035006
- J21. **C. Liu**, S. Fu*, X. Tang, M. Zhang, H. Ren (2019) “Time Varying Hydrodynamic Characteristics Identification of a Flexible Riser under Multi-frequency VIVs” *Journal of Vibration and Shock* 38(1), 149-158 (In Chinese)
- J22. **C. Liu*** (2019) “Teaching control theory in physics: the port Hamiltonian framework” *College Physics* 38(10), 1 (In Chinese) (Outstanding paper award in 2019)

J23. **C. Liu**, S. Fu*, M. Zhang, H. Ren (2018) “Time-varying hydrodynamics of a flexible riser under multi-frequency vortex-induced vibrations” *Journal of Fluids and Structures* 80, 217-244

PEER-REVIEWED CONFERENCE PROCEEDINGS

*: corresponding author, ____: research mentee

- C1. **C. Liu***, **Y. Shuai**, **A. Rath**, D. F. Gayme (2023) “A structured input-output approach to characterizing optimal perturbations in wall-bounded shear flows” *2023 American Control Conference (ACC)*, San Diego, CA, USA, pp. 2319-2325
- C2. **Y. Shuai**, **C. Liu**, D. F. Gayme* (2022) “Structured input-output analysis of oblique turbulent bands in transitional plane Couette-Poiseuille flow” *12th International Symposium on Turbulence and Shear Flow Phenomena* Osaka, Japan
- C3. **C. Liu***, I. Gluzman, M. Lozier, S. Midya, S. Gordeyev, F. O. Thomas, D. F. Gayme (2021) “Spatial input-output based modeling of large-scale structures in actuated turbulent boundary layers” *AIAA Aviation Forum* 2021
- C4. **C. Liu**, D. F. Gayme* (2019) “Convective velocities of vorticity fluctuations in turbulent channel flows: an input-output based approach” *11th International Symposium on Turbulence and Shear Flow Phenomena* Southampton, UK
- C5. **C. Liu**, S. Fu*, M. Zhang, H. Ren (2017) “Time Varying Hydrodynamics Identification of a Flexible Riser under Multi-frequency Vortex-Induced Vibrations” *36th International Conference on Ocean Offshore and Arctic Engineering* Paper No. OMAE2017-61261

INVITED PRESENTATIONS

- I1. **C. Liu** (2023) “Reduced-order modeling and analysis of fluid flows: from wall-bounded shear flows to convection” *Department of Mechanical Engineering, University of Connecticut*, February 22, 2023, Storrs, Connecticut
- I2. **C. Liu** (2022) “Structured input-output analysis of transitional wall-bounded shear flows” *Institute of Mechanics, Chinese Academy of Sciences*, August 3, 2022 (Online)
- I3. **C. Liu** (2022) “Structured input-output analysis of transitional wall-bounded flows” *Corrsin-Kovaszny Award talk in Center for Environmental & Applied Fluid Mechanics at Johns Hopkins University*, April 22, 2022, Baltimore, Maryland (**Corrsin-Kovaszny Outstanding Paper Award**)
- I4. **C. Liu**, D. F. Gayme (2021) “Structured input-output analysis of wall-parallel length scales in transitional plane Couette flow” *AIAA Aviation 2021 Forum*, August 2-6, 2021, Virtual Event

CONTRIBUTED PRESENTATIONS AND POSTERS

____: research mentee

- P1. **C. Liu**, M. Sharma, K. Julien, E. Knobloch (2023) “Fixed-flux Rayleigh-Bénard convection in doubly periodic domains” *76th Annual Meeting of the APS Division of Fluid Dynamics*, November 19-21, 2023, Washington, DC
- P2. **L. Xu**, A. van Kan, **C. Liu**, E. Knobloch (2023) “Noise-induced transitions in anisotropic two-dimensional turbulence” *76th Annual Meeting of the APS Division of Fluid Dynamics*, November 19-21, 2023, Washington, DC
- P3. **A. Rath**, **C. Liu**, D. F. Gayme (2023) “Structured input-output analysis of transitional Blasius boundary layer flows using a descriptor state space model” *76th Annual Meeting of the APS Division of Fluid Dynamics*, November 19-21, 2023, Washington, DC

- P4. **C. Liu**, A. D. Clark “Semi-analytical solutions of shallow water waves with idealized bottom topographies” (2023) SIAM New York-New Jersey-Pennsylvania Section, October 21-22, 2023, Newark, NJ
- P5. L. Xu, A. van Kan, **C. Liu**, E. Knobloch (2023) “Noise-induced transitions in anisotropic two-dimensional turbulence” *The 2023 Pi² Summer Scholar Symposium*, August 22 2023, Berkeley, CA
- P6. **C. Liu**, Y. Shuai, A. Rath, D. F. Gayme (2023) “A structured input-output approach to characterizing optimal perturbations in wall-bounded shear flows” *American Control Conference 2023*, May 31-June 2, San Diego, California
- P7. T. Tsubota, **C. Liu**, B. Foster, E. Knobloch (2023) “Dynamics of the real Ginzburg-Landau equation on a time-dependent domain” *Poster session of Berkeley Physics Undergraduate Research Scholars Program*, April 14, 2023, Berkeley, California
- P8. L. Xu, A. van Kan, **C. Liu**, E. Knobloch (2023) “Rare Transitions in Anisotropic 2D Turbulence” *Poster session of Berkeley Physics Undergraduate Research Scholars Program*, April 14, 2023, Berkeley, California
- P9. **C. Liu** (2023) “Reduced-order modeling and analysis of fluid flows: from wall-bounded shear flows to salt-finger convection” *Climate Chedann Group*, February 25, 2023 (Online)
- P10. **C. Liu**, K. Julien, E. Knobloch (2023) “Staircase solutions and stability in vertically confined salt-finger convection” *Dynamics Days 2023*, January 9–11, 2023, Hartford, Connecticut (Online)
- P11. **C. Liu**, K. Julien, E. Knobloch (2022) “Staircase solutions and stability in vertically confined salt-finger convection” *75th Annual Meeting of the APS Division of Fluid Dynamics*, November 20-22, 2022, Indianapolis, Indiana
- P12. M. Sharma, **C. Liu**, K. Julien, E. Knobloch (2022) “Modeling salt-finger convection in the oceanic parameter regimes” *75th Annual Meeting of the APS Division of Fluid Dynamics*, November 20-22, 2022, Indianapolis, Indiana
- P13. Y. Shuai, **C. Liu**, D. F. Gayme (2022) “Structured input-output analysis of oblique laminar-turbulent flow patterns in transitional plane Couette-Poiseuille flow” *75th Annual Meeting of the APS Division of Fluid Dynamics*, November 20-22, 2022, Indianapolis, Indiana
- P14. A. Rath, **C. Liu**, D. F. Gayme (2022) “Structured input-output analysis of transitional Blasius boundary layer flows using a descriptor state space model” *75th Annual Meeting of the APS Division of Fluid Dynamics*, November 20-22, 2022, Indianapolis, Indiana
- P15. T. Tsubota, **C. Liu**, B. Foster, E. Knobloch (2022) “Dynamics in the real Ginzburg-Landau equation on a time-dependent domain” *The 2022 Pi² Summer Scholar Symposium*, August 22, 2022, Berkeley, California
- P16. Y. Shuai, **C. Liu**, D. F. Gayme (2022) “Structured input-output analysis of oblique turbulent bands in transitional plane Couette-Poiseuille flow” *Twelfth International Symposium on Turbulence and Shear Flow Phenomena (TSFP12)*, July 19-22, 2022, Osaka, Japan (Online)
- P17. **C. Liu**, K. Julien, E. Knobloch (2022) “Staircase solutions and stability in bounded salt-finger convection” *Boulder School for Condensed Matter and Materials Physics 2022: Hydrodynamics Across Scales*, July 4-29, 2022, Boulder, Colorado
- P18. **C. Liu**, E. Knobloch, (2022) “Staircase solutions and stability in bounded salt-finger convection” *Euromech Colloquium 619 Oberbeck-Boussinesq Hypothesis and Beyond in stratified turbulence*, July 4-8, 2022, Wien, Austria (Hybrid)
- P19. **C. Liu**, E. Knobloch (2022) “Single mode solutions to convection in a porous medium”, *Dynamics Days 2022*, January 7-8, 2022 Atlanta, GA (Online)

- P20. **C. Liu**, C. P. Caulfield, D. F. Gayme (2021) “Structured input-output analysis of stably stratified plane Couette flow” *74th Annual Meeting of the APS Division of Fluid Dynamics*, November 21-23, 2021, Phoenix, Arizona
- P21. **C. Liu**, I. Gluzman, M. Lozier, S. Midya, S. Gordeyev, F. O. Thomas and D. F. Gayme (2021) “Spatial input-output analysis of large-scale structures in actuated turbulent boundary layers” *AIAA Aviation 2021 Forum*, August 2-6, 2021, Virtual Event
- P22. **C. Liu**, D. F. Gayme (2021) “Structured input-output analysis of dominant flow structures in transitional plane Couette flow” *IPAM Workshop Transport and Mixing in Complex and Turbulent Flows*, January 11-14, 2021, Los Angeles, California (Virtual)
- P23. **C. Liu**, D. F. Gayme (2020) “A linear matrix inequality based approach for efficient approximation of permissible perturbation amplitude in wall-bounded shear flows at transitional Reynolds numbers” *73rd Annual Meeting of the APS Division of Fluid Dynamics*, November 22-24, 2020, Chicago, Illinois (Virtual)
- P24. **C. Liu**, D. F. Gayme (2019) “Convective velocities of vorticity fluctuations in turbulent channel flows: an input-output approach”, *11th International Symposium on Turbulence and Shear Flow Phenomena (TSFP11)*, July 30-August 2, 2019, Southampton, UK
- P25. **C. Liu**, D. F. Gayme (2018) “Input-output based analysis of convective velocity in turbulent channels”, *71st Annual Meeting of the APS Division of Fluid Dynamics*, November 18–20, 2018; Atlanta, Georgia
- P26. **C. Liu**, S. Fu, M. Zhang, H. Ren (2017) “Time varying hydrodynamics identification of a flexible riser under multi-frequency vortex-induced vibrations” *36th International Conference on Ocean, Offshore & Arctic Engineering*, June 25-30, 2017, Trondheim, Norway

RESEARCH MENTEE

Ph.D. students

- Aishwarya Rath (Co-advised with Dennice F. Gayme) “Structured input-output analysis of transitional boundary layers”

Undergraduate students

- Zhiwei (Dave) Li (Co-advised with Adrian van Kan and Edgar Knobloch) “Traveling localized structured within inclined convection in porous medium”
- Lichuan Xu (Co-advised with Adrian van Kan and Edgar Knobloch) “Noise-induced transition in two-dimensional turbulence” (supported by Pi²(\$6600) and BPURS(\$750))
- Troy Tsubota (Co-advised with Benjamin Foster and Edgar Knobloch) “Real Ginzburg-Landau equations in time-varying domain” (supported by Pi²(\$6500) and BPURS(\$750))
- Yu Shuai (Co-advised with Dennice F. Gayme) “Structured input-output analysis of plane Couette-Poiseuille flow” Next position: Ph.D. student at Princeton University

Pi²: Physics Innovators Initiative Summer Scholars; BPURS: Berkeley Physics Undergraduate Research Scholars

TEACHING

Teaching assistant/Instructor

Johns Hopkins University, Baltimore, MD

9/18 - 5/21

- Undergraduate course: EN.530.334 SP 21 Heat Transfer
- HEART instructor: EN.500.111 FA20 Simple Mathematics Revealing Big Physics
- Undergraduate course: EN.530.343 SP20 Design and Analysis of Dynamical Systems
- Undergraduate/Graduate course: EN.530.424/EN.530.624 FA19 Dynamics of Robots and Spacecraft

- Undergraduate course: EN.530.470 SP19 Space Vehicle Dynamics and Control
- Graduate course: EN.530.761 FA18 Mathematical Methods of Engineering I

ACADEMIC SERVICE

Reviewer: Journal of Fluid Mechanics, Computers and Fluids, Marine Structures, Ocean Engineering, Journal of Offshore Mechanics and Arctic Engineering, IEEE Control Systems Letters, Physica Scripta, Chaos, Solitons and Fractals

Selection Committee of Physics Innovators Initiative (Pi²) at University of California, Berkeley

FIRST AUTHOR JOURNAL ARTICLE NUMBERS

Journal of Fluid Mechanics (4), Physical Review E (1), AIAA Journal (1), Geophysical & Astrophysical Fluid Dynamics (2), Fluids (1), Journal of Fluids and Structures (2), Physics Letters A (1)

Updated on August 24, 2023