CHANG LIU

+1 410-369-6999 ◇ chang_liu@uconn.edu ◇ https://cliu124.github.io ◇ Google Scholar ◇ ResearchGate

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-Kovasznay 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. A. Rath, **C. Liu**, D. F. Gayme "Optimal perturbations in transitional Blasius boundary layers: A structured approach" *13th International Symposium on Turbulence and Shear Flow Phenomena*, Montréal, Canada (Under Review)

C2. **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

C3. 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

C4. **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

C5. **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

C6. **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) "Structured input-output analysis of wall-bounded shear flows" *Pre-APSDFD23 Workshop: The intersection of experiments, machine learning, and dynamical systems approaches to turbulent/complex fluid flows in energy systems and the environment*, November 16-17, 2023, Durham, New Hampshire

I2. **C. Liu** (2023) "Reduced-order modeling and analysis of fluid flows" *Department of Mechanical Engineering, University of Connecticut*, September 8, 2023, Storrs, Connecticut

I3. **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

I4. **C. Liu** (2022) "Structured input-output analysis of transitional wall-bounded shear flows" *Institute of Mechanics, Chinese Academy of Sciences*, August 3, 2022 (Online)

I5. **C. Liu** (2022) "Structured input-output analysis of transitional wall-bounded flows" *Corrsin-Kovasznay Award talk in Center for Environmental & Applied Fluid Mechanics at Johns Hopkins University*, April 22, 2022, Baltimore, Maryland **(Corrsin-Kovasznay Outstanding Paper Award)**

I6. **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 Pi^2 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 Pi^2 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

· Kalin Kochnev"Quantum computing for hydrodynamic stability" *09/2023 - now*

· 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 Pi^2($6600) and BPURS($750)) *03/2023 - now*

· Troy Tsubota (Co-advised with Benjamin Foster and Edgar Knobloch) "Real Ginzburg-Landau equations in time-varying domain" (supported by Pi^2($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

Pi^2: 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

University of Connecticut

Graduate Admission Committee *2023*

University of California, Berkeley

Selection Committee of Physics Innovators Initiative (Pi^2) *2023*

Journal 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

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 September 9, 2023