





HAOTIAN HANG

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Contact Information

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🏠: *Personal Website*

Education

- 2020 - **University of Southern California**, Los Angeles, CA
Ph.D. Candidate, Mechanical Engineering, (2022/8 passed qualifying exam, 2024 winter anticipated)
Master of Science, Computer Science (High Performance Computing track), Dec 2023
- 2015 - 2019 **Shanghai Jiao Tong University**, Shanghai, China
B.S. Aeronautics and Astronautics Engineering, June 2019 (Average Score: 89.22/100)

Employment

- 2020 - **Research Assistant**, Bio-Inspired Motion Lab at USC, PI: *Prof. Eva Kanso*
- 2023/6 - 8 **Quantitative Analyst Intern**, Corporate Model Risk, Wells Fargo, Manager: *Dr. Nengfeng Zhou*
Evaluate robustness of machine learning models
Discover the contribution of each feature on robustness metrics and overfitting
Compare different perturbation schemes in robustness testing
Develop nonlinear variance inflation factor (VIF) to evaluate the nonlinear correlation in dataset
- 2019/9 - 12 **Intern Algorithmic Engineer**, Shanghai Hongpu Information Technology Co., Ltd.
Conduct flaw detection on images of photovoltaic cell using Faster R-CNN and yolov3
- 2016 - 2019 **Research Assistant**, J.C.Wu Center for Aerodynamics, PI: *Prof. Hong Liu*

Publications

- 2024 8. Jiao, Y., **Hang, H.**, Merel, J., & Kanso, E. (in preparation). Sensing flow gradients is necessary for learning autonomous underwater navigation
7. **Hang, H.**, Jiao, Y., Heydari, S., Ling, F., Merel, J. & Kanso, E. (submitted). *Interpretable and generalizable strategies for stably following hydrodynamic trails*
6. Heydari, S., **Hang, H.**, & Kanso, E. (under review at ELife). *Mapping spatial patterns to energetic benefits in groups of flow-coupled swimmers*
5. **Hang, H.**, Heydari, S. & Kanso, E. Feedback control of uncoordinated flapping swimmers to maintain school cohesion. American Control Conference (ACC) 2024
- 2023 4. Qin, S., **Hang, H.**, Xiang, Y. & Liu, H. (2023). *Reynolds-number scaling analysis on lift generation of a flapping and passive rotating wing with an inhomogeneous mass distribution*. Chinese Journal of Aeronautics, 37(2), 259-269
- 2022 3. **Hang, H.**, Heydari, S., Costello, J., & Kanso, E. (2022). *Active tail flexion in concert with passive hydrodynamic forces improves swimming speed and efficiency*. Journal of Fluid Mechanics, 932, A35.
- 2021 2. Xiang, Y., **Hang, H.**, Qin, S., & Liu, H. (2021). *Scaling analysis of the circulation growth of leading-edge vortex in flapping flight*. Acta Mech. Sin, 37(10), 1530-1543.
- 2020 1. **Hang, H.**, Yu, B., Xiang, Y., Zhang, B., & Liu, H. (2020). *An objective-adaptive refinement criterion based on modified ridge extraction method for finite-time Lyapunov exponent (FTLE) calculation*. Journal of Visualization, 23(1), 81-95.

Talks/Presentations

- 2024 **APS March Meeting**, Learning to track flows
- 2023 **APS Division of Fluid Dynamics Meeting**, Flow-coupled swimmers self-organize into energetically cooperative or greedy spatial patterns
So Cal Fluids XVI, Active tail flexion in concert with passive hydrodynamic forces improves swimming speed and efficiency
- 2022 **APS Division of Fluid Dynamics Meeting**, Learning to blindly follow hydrodynamic trails
So Cal Fluids XV, Learning to blindly follow hydrodynamic trails
- 2021 **APS Division of Fluid Dynamics Meeting**, Active tail flexion in concert with passive hydrodynamic forces improves swimming speed and efficiency
- 2020 **APS Division of Fluid Dynamics Meeting**, Flowtaxis in the wakes of oscillating airfoils
- 2018 **APS Division of Fluid Dynamics Meeting**, Passive rotation of a flapping wing with an inhomogeneous mass distribution




Research Interests/Experience

- 2023 - **Collective locomotion in complex geometry**, supervised by *Prof. Eva Kanso, Prof. Alex Barnett*
Employ Boundary Element method (BEM) to model the hydrodynamic interaction between fish school and arbitrary geometry
Study the transition of fish school in a bi-chamber domain
- 2021 - **School cohesion and energetic benefits of fish school**, supervised by *Prof. Eva Kanso, Prof. Matt McHenry*
Develop efficient parallelized code using fast multipole method (FMM) to simulate emergent formation of fish schools composed of up to 10 fishes
Evaluate the energetic benefit and stability of fish schools of different different spatial patterns
Design control laws to stabilize fish schools that are passively unstable
Study the dynamically-changing real fish schools using graph neural network
- 2020 - **Tracking hydrodynamic trails using deep reinforcement learning**, supervised by *Prof. Eva Kanso, Dr. Josh Merel*
Employ reinforcement learning to follow vortical wakes based on local flow sensory
Find the importance of the wake's periodicity and traveling wave characteristic in source seeking
Analyze the controller in a simplified signal field and prove that stability of the controller depends on the location of sensor
Compare performance among different sensory cues, especially between mechano- and chemo- sensing
- 2020 - **Flexion in fish swimming**, supervised by *Prof. Eva Kanso, Prof. John H. Costello*
Analyze the role of active and passive flexion on swimming speed and efficiency of a self-propelling pitching plate using vortex sheet method
Parametric study on effects of flexion phase, flexion angle and flexion ratio on swimming performance
Find overlap between biological data and the region we proposed to have hydrodynamic benefits in parameter space
- 2016 - 2019 **High lift generation mechanisms of insects' flight**, supervised by *Prof. Hong Liu, Prof. Yang Xiang and Dr. Suyang Qin*
Conduct experimental study using robotic flapping wing models in glycerin with Reynolds number similar to insects
Measure flow field using particle image velocimetry (PIV) and measure force and torque using 6-axis force sensor, analogue filter and NI data acquisition system
Study formation of leading edge vortex(LEV) for different kinematic modes, and find advanced rotation can generate a larger LEV because of wake capture
Find a scaling law between passive rotation and active translation in flapping wing model
- 2016 - 2019 **AMR for FTLE calculation**, supervised by *Prof. Hong Liu, Prof. Bin Zhang, Bin Yu and Prof. Yang Xiang*
Develop a physics-based adaptive refinement method for finite-time Lyapunov exponent calculation
- 2015 - 2016 **VTOL pitch-changed quadrotor** , supported by National Students' Platform for Innovation and Entrepreneurship Training , supervised by *Prof. Junqi Wu*
Lead a team to make a quadrotor and implement pitch-changed technique and VTOL technique in terms of both mechanical and control

Teaching Experience

- at University of Southern California**
- 2021 Spring **Teaching Assistant**, AME-526, Introduction to mathematical methods in engineering II, *Prof. Niema Pahlevan*
- 2020 Fall **Teaching Assistant**, AME-404, Computational Solutions to Engineering Problems, *Prof. Takahiro Sakai*

Open Source Projects

- 2023- Field-Oriented Control (FOC) on STM32  [Github Link](#)
- 2021- Inferring unknown parameters of partially-observable system using Physics-informed-DeepONet  [Github Link](#)
- 2021 - 2022 Parallel C++ Implementation of Proximal Policy Optimization (PPO)  [Github Link](#)

Student Mentees

	at University of Southern California
2023 -	Ziyan Zhu, M.S. student
	Ali Khokhar , M.S. student
2023	Donghun (Calvin) Moon, undergraduate at Columbia University

Service

2024	Judge, Undergraduate Symposium for Scholarly and Creative Work Session Chair, APS March Meeting DFD IX session
2023	Reviewer, American Control Conference (ACC) 2024
	Judge, Undergraduate Symposium for Scholarly and Creative Work
2022	AME 441 project mentor, Robotic fish with artificial lateral line
	Judge, Undergraduate Symposium for Scholarly and Creative Work

Honor/Awards

2022	USC Three Minute Thesis (3MT) competition Finalist Link
2020	USC Viterbi fellowship
2017-2018	Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment of SJTU
2016	Honeywell Star Project Second Place , Parts of the National College Students Physics Competition Third Place , Chinese College Students' Mathematics Competition
2014	First Place , Chinese Chemistry Olympiad First Place , Shanghai Adolescents Science and Technology Innovation Contest

Professional Society Memberships

- American Physical Society (APS)
- Institute of Electrical and Electronics Engineers (IEEE)

Graduate Coursework

	at University of Southern California
2024	AME-530b, Dynamics of Incompressible Fluids, <i>Prof. Mitul Luhar</i>
2023	CSCI-575, Quantum Computing and Quantum Cryptography, <i>Prof. Ming-Deh Huang</i> CSCI-599, An Introduction to Programming Languages, <i>Prof. Mukund Raghothaman</i>
2022	EE-587, Nonlinear Control Systems, <i>Prof. Mihailo Jovanovic</i> CSCI-561, Foundations of Artificial Intelligence, <i>Prof. Wei-Min Shen</i> CSCI-567, Machine Learning, <i>Prof. Victor Adamchik</i> CSCI-653, High Performance Computing and Simulations, <i>Prof. Aiichiro Nakano</i>
2021	PHYS-516, Methods of Computational Physics, <i>Prof. Aiichiro Nakano</i> EE-556, Stochastic Systems and Reinforcement Learning, <i>Prof. Rahul Jain</i> CSCI-570, Analysis of Algorithms, <i>Prof. Victor Adamchik</i> AME-508, Machine Learning and Computational Physics, <i>Prof. Assad Oberai</i>
2020	CSCI-596, Scientific Computing and Visualization, <i>Prof. Aiichiro Nakano</i> AME-525, Engineering Analysis, <i>Prof. Eva Kanso</i> AME-526, Introduction to Mathematical Methods in Engineering II, <i>Prof. Niema Pahlevan</i> AME-511, Compressible Gas Dynamics, <i>Prof. Iván Bermejo-Moreno</i> PHYS-760, Selected Topics in Computational Physics, <i>Prof. Satish Kumar Thittamaranahalli</i> AME-451, Linear Control Systems I, <i>Prof. Henryk Flashner</i> AME-541, Linear Control Systems II, <i>Prof. Néstor O. Pérez-Arancibia</i> AME-535A, Introduction to Computational Fluid Mechanics, <i>Prof. Alejandra Uranga</i> AME-530A, Dynamics of Incompressible Fluids, <i>Prof. Carlos Pantano</i>

Online Coursework

2024	Minds and Machines, MITx Online
2022	C++ Nanodegree, Udacity Qiskit Global Summer School 2022, IBM
2021	Build a Modern Computer from First Principles: From Nand to Tetris (Project-Centered Course), Coursera
2019	Specialization , DeepLearning.AI TensorFlow Developer , Coursera (containing 4 courses) Specialization , Deep Learning, Coursera (containing 5 courses)

