

# 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, Dec 2023
- 2015 - 2019 **Shanghai Jiao Tong University**, Shanghai, China  
B.S. Aeronautics and Astronautics Engineering, June 2019 (Average Score: 89.22/100)

## EMPLOYMENT

- 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
- 2020 - **Research Assistant**, Bio-Inspired Motion Lab at USC, PI: *Prof. Eva Kanso*
- 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

- 2023 8. **Hang, H.**, Heydari, S. & Kanso, E. (under review at ACC 2024) Feedback control of uncoordinated flapping swimmers to maintain school cohesion
7. Jiao, Y., **Hang, H.**, Merel, J., & Kanso, E. (in preparation). Evaluating egocentric and geocentric sensing for efficient underwater navigation using deep reinforcement learning
6. **Hang, H.**, Jiao, Y., Heydari, S., Ling, F., Merel, J. & Kanso, E. (in preparation). Learning to track flows
5. Heydari, S., **Hang, H.**, & Kanso, E. (submitted). Flow-coupled swimmers self-organize into cooperative and selfish spatial patterns
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
- 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., and 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., and 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

- 2023 **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

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- 2021 - **Stability and energy saving of fish schools**, 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 which are passively unstable  
Study the dynamically-changing real fish schools using graph theory
- 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

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- 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

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

## GRADUATE COURSEWORK

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- at **University of Southern California**
- 2023 CSCI-575, Quantum Computing and Quantum Cryptography, *Prof. Ming-Deh Huang*
- 2022 EE-587, Nonlinear Control Systems, *Prof. Mihailo Jovanovic*  
CSCI-561, Foundations of Artificial Intelligence, *Prof. Wei-Min Shen*  
CSCI-567, Machine Learning, *Prof. Victor Adamchik*  
CSCI-653, High Performance Computing and Simulations, *Prof. Aiichiro Nakano*
- 2021 PHYS-516, Methods of Computational Physics, *Prof. Aiichiro Nakano*  
EE-556, Stochastic Systems and Reinforcement Learning, *Prof. Rahul Jain*

2020	CSCI-570, Analysis of Algorithms, <i>Prof. Victor Adamchik</i>
	AME-508, Machine Learning and Computational Physics, <i>Prof. Assad Oberai</i>
	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>

## HONOR/AWARDS

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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
	<b>Second Place</b> , Parts of the National College Students Physics Competition
	<b>Third Place</b> , Chinese College Students' Mathematics Competition
2014	<b>First Place</b> , Chinese Chemistry Olympiad
	<b>First Place</b> , Shanghai Adolescents Science and Technology Innovation Contest

## SERVICE

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2023	Reviewer, American Control Conference (ACC) 2024
	Judge, Undergraduate Symposium for Scholarly and Creative Work
Fall 2022	AME 441 project mentor, Robotic fish with artificial lateral line
2022	Judge, Undergraduate Symposium for Scholarly and Creative Work

## ONLINE COURSEWORK

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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	<b>Specialization</b> , DeepLearning.AI TensorFlow Developer , Coursera (containing 4 courses)
	<b>Specialization</b> , Deep Learning, Coursera (containing 5 courses)
	Machine Learning, Coursera,
2014	General Chemistry, Coursera

## TECHNICAL SKILLS

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Programming Language:	Python, C/C++, Matlab, Fortran
Machine learning framework:	Pytorch, Tensorflow
Micro controller:	Arduino, Raspberry Pi, Pixhawk, stm32
Other softwares/ tools:	Solidworks, Fusion 360, ROS/ROS2, Gazebo, github, L <sup>A</sup> T <sub>E</sub> X, Docker, Ansys Fluent, Linux, MPI, OpenMP, cuda