# HAOTIAN HANG

July, 2023

## CONTACT INFOMATION

**Mobile:** (213)462-5919  
**E-mail:** haotianh@usc.edu, hanghaotian@gmail.com  
**Social media:**  ○ in R⁶ ♂

**Address:** 920 Downey way, Los Angeles, CA 90089  
**Webpage:** *Personal Website*

## EDUCATION

| | |
|---|---|
| 2020 - | **University of Southern California**, Los Angeles, CA |
| | Ph.D. Candidate, Mechanical Engineering, (2022/8 passed qualifying exam, 2024 anticipated) |
| | Master of Science, Computer Science, 2024 anticipated |
| 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 |
| 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 | 6. **Hang, H.**, Jiao, Y, Heydari, S., Merel, J. & Kanso, E. (in preparation). Parsimonious flow sensing strategies exploit traveling wave character to track hydrodynamic trails |
| | 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. (submitted). Reynolds-number scaling analysis on lift generation of a flapping and passive rotating wing with an inhomogeneous mass distribution |
| 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. |
| 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

| | |
|---|---|
| 2021 - | **Stability and energy saving of fish schools**, supervised by *Prof. Eva Kanso* |
| |     joint with *Dr. Sina Heydari* |
| | Develop efficient parallelized code 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 |

| 2020 - | **Tracking hydrodynamic trails using deep reinforcement learning**, supervised by *Prof. Eva Kanso* |
|---|---|

| | joint with *Dr. Sina Heydari, Dr. Yusheng Jiao* |

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* |
|---|---|

joint with *Dr. Sina Heydari*

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 lager 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* |
|---|---|

joint with *Dongming Ding, Jihong Huang, Chaoqun Li, Zhikang Qiu*

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* |

## GRADUATE COURSEWORK

**at University of Southern California**

| 2023 | CSCI-575, Quantum Computing and Quantum, *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* |
| | CSCI-570, Analysis of Algorithms, *Prof. Victor Adamchik* |
| | AME-508, Machine Learning and Computational Physics, *Prof. Assad Oberai* |
| | CSCI-596, Scientific Computing and Visualization, *Prof. Aiichiro Nakano* |
| 2020 | AME-525, Engineering Analysis, *Prof. Eva Kanso* |
| | AME-526, Introduction to Mathematical Methods in Engineering II, *Prof. Niema Pahlevan* |
| | AME-511, Compressible Gas Dynamics, *Prof. Iván Bermejo-Moreno* |
| | PHYS-760, Selected Topics in Computational Physics, *Prof. Satish Kumar Thittamaranahalli* |
| | AME-451, Linear Control Systems I, *Prof. Henryk Flashner* |
| | AME-541, Linear Control Systems II, *Prof. Néstor O. Pérez-Arancibia* |

AME-535A, Introduction to Computational Fluid Mechanics, *Prof. Alejandra Uranga*
AME-530A, Dynamics of Incompressible Fluids, *Prof. Carlos Pantano*

## HONOR/AWARDS

| | |
|---|---|
| 2022 | USC Three Minute Thesis (3MT) competition Finalist |
| 2020 | USC Viterbi felloship |
| 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 |

## SERVICE

| | |
|---|---|
| 2023 | Judge, Undergraduate Symposium for Scholarly and Creative Work |
| 2022 | Judge, Undergraduate Symposium for Scholarly and Creative Work |

## ONLINE COURSEWORK

| | |
|---|---|
| 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) |
| | Machine Learning, Coursera, |
| 2014 | General Chemistry, Coursera |

## TECHNICAL SKILLS

| | |
|---|---|
| Programming Language: | Python, Matlab, Fortran, C/C++, MySQL |
| Machine learning framework: | Pytorch, Tensorflow |
| Micro controller: | Arduino, Raspberry Pi, Pixhawk, stm32 |
| Other softwares/ tools: | Solidworks, Fusion 360, ROS/ROS2, Gazebo, github, LaTeX, Docker, Ansys Fluent, Linux, MPI, OpenMP, cuda, Numpy, Scipy, matplotlib, pandas |