QIANG ZHONG

Assistant Professor
Department of Mechanical Engineering, Iowa State University,
2025 Black Engineering, Ames, Iowa, 50010

Qzhong1@iastate.edu | 434-409-0869 | https://www.qzhonglab.com/

Research interests: my primary research focuses on the intersection of fluid mechanics, and robotics to explore the principal physics of fluid-robot systems with an eye toward developing ultra-performance robotic systems with embodied intelligence for underwater and aerial explorations.

APPOINTMENTS

Iowa State University   2022 - present

Assistant Professor, Mechanical Engineering

University of Virginia   2021- 2022

Postdoctoral Researcher, Mechanical and Aerospace Engineering

EDUCATIONS

University of Virginia   2021

- Ph.D. in Mechanical Engineering
- Advisor: Daniel. B. Quinn

University of Pittsburgh   2016

- M.Sc. in Mechanical Engineering
- Advisor: Nitin Sharma

Zhejiang University, Hangzhou, China   2014

- B.Eng. in Bio-system Engineering

SECTION LINKS

1. Publications
2. Honors and Awards
3. Academic Service
4. Invited Talks and Exhibitions
5. Selected Media Coverage
6. Teaching and Mentoring

1 PUBLICATIONS

Google Scholar | Researchgate

Corresponding author

Published

1. **Zhong, Q.*,** Fu, Y., Liu, L., Leo Liu, and Quinn, D.B. (2022). Development of a Stingray-inspired High-Frequency Platform with Variable Wavelength. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. Accepted.

2. **Zhong, Q.*,** Zhu, J., Fish, F. E., Kerr, S. J., Downs, A. M., Bart-Smith, H., & Quinn, D. B. (2021). Tunable stiffness enables fast and efficient swimming in fish-like robots. *Science Robotics,* 6(57).
   - Highlighted on *Science* Magazine and *Science Robotics* homepage, social media, UVA news, Physicsworld, Engadget, etc

3. **Zhong, Q.*,** Han, T., Moored, K. W., & Quinn, D. B. (2021). Aspect ratio affects the equilibrium altitude of near-ground swimmers. *Journal of Fluid Mechanics,* 917.

4. **Zhong, Q.*,** Dong, H., & Quinn, D. B. (2019). How dorsal fin sharpness affects swimming speed and economy. *Journal of Fluid Mechanics,* 878, 370-385.

5. **Zhong, Q.*,** & Quinn, D. B. (2021). Streamwise and lateral maneuvers of a fish-inspired hydrofoil. *Bioinspiration & Biomimetics.*

6. Mivehchi, A., **Zhong, Q.,** Kurt, M., Quinn, D. B., & Moored, K. W. (2021). Scaling laws for the propulsive performance of a purely pitching foil in ground effect. *Journal of Fluid Mechanics,* 919.

7. Ayancik, F., **Zhong, Q.,** Quinn, D. B., Brandes, A., Bart-Smith, H., & Moored, K. W. (2019). Scaling laws for the propulsive performance of three-dimensional pitching propulsors. *Journal of Fluid Mechanics,* 871, 1117-1138.

8. Kurt, M., Cochran-Carney, J., **Zhong, Q.,** Mivehchi, A., Quinn, D. B., & Moored, K. W. (2019). Swimming freely near the ground leads to flow-mediated equilibrium altitudes. *Journal of Fluid Mechanics,* 875.

9. Gunnarson, P., **Zhong, Q.,** & Quinn, D. B. (2019). Comparing Models of Lateral Station-Keeping for Pitching Hydrofoils. *Biomimetics,* 4(3), 51.

10. Zeyghami, S., **Zhong, Q.,** Liu, G., & Dong, H. (2019). Passive pitching of a flapping wing in turning flight. *AIAA Journal,* 57(9), 3744-3752.

11. Allen, M., **Zhong, Q.,** Kirsch, N., Dani, A., Clark, W. W., & Sharma, N. (2017). A nonlinear dynamics-based estimator for functional electrical stimulation: Preliminary results from lower-leg extension experiments. *IEEE Transactions on Neural Systems and Rehabilitation Engineering,* 25(12), 2365-2374.

12. **Zhong, Q.*,** Liu, G., Ren, Y., & Dong, H. (2017). On the passive pitching mechanism in turning flapping flights using a torsional spring model. *AIAA Fluid Dynamics Conference* (p. 3817).

13. Zhu, R., **Zhong, Q.,** Quinn, D. B., Zhu, J., & Bart-Smith, H. (2018, March). Effects of Tail Planform Shape on Stability and Propulsive Performance of Bio-Inspired Swimming. *Integrative and Comparative Biology* (Vol. 58, pp. E262-E262).

Under review/submitted/in preparation

14. **Zhong, Q.*** and Quinn, D.B. (2022). Deflected jet of a high Strouhal number pitching foil is time-varying. *To be submitted.*

15. Han, T., **Zhong, Q.,** Quinn, D.B., Moored, K. (2022). Force Decomposition of a Pitching Foil under Unsteady Ground Effect. *To be submitted.*

16. Liu, Y., **Zhong, Q.,** Quinn, D.B. (2022). Asymmetry pitching motion shifts the equilibrium altitude of unsteady ground effects without performance loss. *To be submitted.*

17. **Zhong, Q.*,** Chuanhao Li., Quinn, D.B. (2022). Machine learning-based optimal swimming strategy in complex fluid environments. *In prepare.*

2 HONORS AND AWARDS

University of Virginia MAE Outstanding Scientist Award   2022

• Awarded for Research Scientist who best demonstrates scholarly excellence and research enterprise

ACCelerate Creativity + Innovation Festival   2022

• Invited as one of three research projects representing UVA to host a public exhibition at Smithsonian National Museum of American History

University of Virginia John E. Scott Award   2021

• Awarded for distinguished research on fluid dynamics (1 per year)

University of Virginia MAE Outstanding Graduate Student Award   2021

• Awarded for distinguished research progress as a graduate student

Virginia Engineering Foundation Graduate Fellowship   2020

• Fellowship for outstanding engineering research

University of Virginia Engineering Research Symposium (UVERS) Award   2018

• Awarded for research poster competition

ACCelerate Creativity + Innovation Festival   2017

• Invited as one of four research projects representing UVA to present at Smithsonian National Museum of American History

National Undergraduate Research Training Initiative Award   2013

• Awarded for outstanding undergraduate research by Ministry of Education of China

3   ACADEMIC SERVICE

International conference founder and organizer

Co-organizer of ISOPE 2022 Special Section: Intelligent Hydrodynamics   2022
- Awarded for Research Scientist who best demonstrates scholarly excellence and research enterprise

Co-founder of Intelligent and Bio-inspired Mechanics Seminar (IBiM)   2020 - Present
- Invited as one of three research projects representing UVA to host a public exhibition at Smithsonian National Museum of American History

Reviewer

- Journal of Fluid Mechanics
- Scientific Report
- ISOPE 2022
- Journal of Bionic Engineering
- Journal of Fluid and Structures
- AIAA Journal
- PLOS One
- Bioinspiration & Biomimetics
- ASME Journal of Fluid Engineering
- International Conference on Robotics and Automation (ICRA)
- IEEE Access
- Journal of Mechanical Engineering Science

4   INVITED TALKS AND EXHIBITIONS

Invited exhibition: ACCelerate Creativity + Innovation National Festival   2022
- Topic: What can robots learn from fish?

Invited seminar: Georgia Institute of Technology   2022
- Topic: Fish, Robot, and Physics: How Fluid Mechanics Endows Underwater Robots with Embodied Intelligence

Invited seminar: University of Wisconsin - Madison   2022
- Topic: Fish, Robot, and Physics: Embodied Intelligence in Underwater Robots

Invited seminar: Iowa State University   2021
- Topic: Cyber-Physical Fluid-Robot Systems for Underwater Explorations

Invited seminar: Swiss Federal Institute of Technology Lausanne (EPFL)   2021
- Topic: Physics-driven Bio-inspired Robots

Invited presentation: Peking University   2021
- Topic: Fluid-Structure Interactions and Active Control in high-performance fish swimming

Invited seminar: Shanghai Jiao Tong University   2021
- Topic: Bio-inspired Smart Fluid Systems

Invited presentation: Zhejiang University   2021

- Topic: Bio-inspired Smart Fluid Systems

Invited seminar: Intelligent and Bio-inspired Mechanics Seminar (IBiM)	2021

- Topic: Two secrets of fish swimming

Poster presentation: University of Virginia Engineering Research Symposium (UVERS)	2018

- Topic: How dorsal fin sharpness affects swimming speed and efficiency

Invited exhibition: ACCelerate Creativity + Innovation National Festival	2017

- Topic: Mantabot: An autonomous underwater vehicle inspired by ray

Conference presentations (APS DFD, Inter.Comp.Biol)	2017 - Present

5   SELECTED MEDIA COVERAGE

- UVA news: A Robotic Fish Tail and an Elegant Math Ratio Could Inform the Design of Next-Generation Underwater Drones

- Physicsworld: 'Tuneable tuna' makes a better robotic swimmer

- Engadget: A new tuna robot could lead to more agile and efficient underwater drones

- Popular Science: A tuna robot reveals the art of gliding gracefully through water

- New Atlas: Robotic tuna uses variable-stiffness tail for more efficient swimming

- SciTech Daily: Secrets of Highly Efficient Swimming Uncovered for Design of Next-Generation Underwater Drones

- Techxplore: A robotic fish tail and an elegant math ratio could inform the design of next- generation underwater drones

- E&T: Robotic fish tail could pave way for next-gen underwater drone design

- BIG THINK: What robots can learn from fish and fancy math

- Mirage: Robotic fish tail and an elegant math ratio could inform design of next-gen underwater drones

- Bullfrag: This is the first fish-shaped robot that is able to swim quickly and efficiently

- Brighter side of News: A robotic fish tail and next-gen underwater vehicles

- SlashGear: Robotic tuna moves like the real thing

6   TEACHING AND MENTORING

Teaching Experience

Co-instructor	2022

- MAE 6592, Dynamical Systems. Core course of UVA Cyber-Physical Systems certificate program.

Guest Lecturer	2020

- MAE 6592, Dynamical Systems. Core course of UVA Cyber-Physical Systems certificate program.
- My contribution: contributed the multidisciplinary learning methodology, designed the hands-on project hardware, learning material, and examples, taught four lab lectures.

Teaching Assistant   2022

- MAE 2320, Dynamics, Undergraduate level

Mentoring Experience

Leo (Yunxi) Liu   2019 - present

- Graduate Student, University of Virginia
- Research topic: Exploring unsteady ground effects using a cyber-physical rig

Yicong Fu   2021 - present

- Undergraduate Student, University of Virginia
- Post UVA: Graduate Student at Cornell
- Research topic: Developing sting-ray inspired undulatory motion test rig

Peter Gunnarson   2018 - 2019

- Undergraduate Student, University of Virginia
- Research topic: Comparing Models of Lateral Station-Keeping for Pitching Hydrofoils
- Post UVA: Graduate Student at Caltech

Wei Wang   2018

- Visiting Undergraduate Student, Beijing Institute of Technology
- Research topic: Developing miniature stiffness control actuator
- Post UVA: Graduate Student at UCSD

Kohl Orson   2017 - 2018

- Undergraduate Student, University of Virginia
- Research topic: Developing leveling system for cyber-physical rig
- Post UVA: Flight test engineer at NAVAIR

Peyton Hooker   2017 - 2018

- Undergraduate Student, University of Virginia
- Research topic: Developing water tunnel frame system for PIV
- Post UVA: Graduate Student at U. Michigan

Maggie Story   2017 - 2018

- Undergraduate Student, University of Virginia
- Research topic: Developing water tunnel speed control circuit
- Post UVA: Engineer for U.S. Navy