

# ZHU JIN

email: [zhu jin0301@163.com](mailto:zhu jin0301@163.com) | tel: +86 18851328992 | homepage: <https://zhu jin2002.github.io>

## EDUCATION

**UM-SJTU Joint Institute, Shanghai Jiao Tong University, Shanghai, China.**

*Sep 2023 - present*

*Master of Engineering in Mechanical Engineering*

Thesis title: “Bacterial Locomotion in Swimming and Swarming Motilities” - Supervised by Zijie Qu

**UM-SJTU Joint Institute, Shanghai Jiao Tong University, Shanghai, China.**

*Sep 2019 - Aug 2023*

*Bachelor of Engineering in Mechanical Engineering*

## PUBLICATION

**Zhu, J., Qiao, Y., Yan, L., Zeng, Y., Wu, Y., Bian, H., Huang, Y., Ye, Y., Huang, Y., Hii, C. Russell, Teng, Y., Guo, Y., Li, G, and Qu, Z., Propulsion Contribution from Individual Filament in a Flagellar Bundle.** arXiv preprint [arXiv:2407.16532](https://arxiv.org/abs/2407.16532). (Under Review)

## ABSTRACTS AND PRESENTATIONS

**The 13th Chinese Fluid Mechanics Academic Conference, Presenter.**

*2024*

Qu, Z., **Zhu, J.**, Qiao, Y., Yan, L., Zeng, Y., Wu, Y., Study on Microbial Flagellar Bundling Process and Propulsive Force Generation Based on Macroscopic Experimental Model.

## RESEARCH EXPERIENCE

**Study on *Enterobacter* sp. SM3 swarming under Different Conditions**

*Jun 2024 - Present*

- Verifying influences of gravity and solid boundary to bacterial swarming by monitoring the colony growth microscopically and microscopically, using self-developed imaging platform to record and quantitate and microscope
- Analyzing characteristic velocity, length, and time scales for bacterial motion in different areas of the swarming colonies (edge, near-edge, far-edge) by using particle image velocimetry (PIV) and optical flow methods
- (Expected) Building a theoretical model to explain the growth of swarming colony affected by gravitation force and under solid surface constrain based on experimental results and analysis

**Experimental Study on Microbial Movement under Interface Constraint**

*Mar 2024 - Present*

- Applying a 3D real-time tracking microscope to track the swimming microorganism for long time ( $> 15s$ )
- Measuring the swimming characteristics, including speed distribution, trajectory curvature, of smooth-swimming *E. coli* on near solid surfaces (glass slides) and semi-solid surfaces (non-nutrient agar of different concentration)
- (Expected) Building a theoretical model to explain the trends of “pusher” type cells’ attraction to softer surfaces

**A Macroscopic Model of Bacterial Flagella Interaction and Propulsion Generation**

*Aug 2022 - Jun 2024*

- Designed and Developed a multi-functional macroscopic experimental platform to test model bacterial flagella interaction and propulsion generation under different parameters including separation distance and phase difference
- Observed the differences of individual contribution from each filament to total propulsion force when phase difference existed, and revealed hydrodynamic interactions reached maximum when phase difference equals to  $\pi$  and  $-\pi$
- Proposed a bacterial swimming model to explain the “wobble” phenomenon in *E. coli* locomotion based on experimental results of unequal propulsion forces generated by individual filaments in a bundle

**Microfluidic Robot Powered by Electroosmosis-based Electrode Arrays**

*Dec 2021 - Aug 2022*

- Simulated liquid pumping with ac-voltages applied to asymmetric electrode pairs by COMSOL, and obtained optimal electrodes pair size ratio of 5:3 under  $V_{pp} = 8V$  and 3 kHz frequency with experiment verification
- Simulated pumping force of 5 sets of 20-electrodes-array applying travelling-wave electroosmosis (TWEO) under  $V_{pp} = 3V$  and 4 kHz frequency, achieved  $3 \mu m/s$  swimming speed of a  $1.8 mm \times 1.3 mm$  chip in experiments

**Multi-material Direct Ink Writing 3D Printer Construction**

*Aug 2021 - Dec 2021*

- Designed the structure and electronic control of a easily-assembled DIW printing extruder to lower the cost by 30%
- Investigated the impact of different infill density, infill patterns and surface density, on material properties of 3D-printed objects by optimizing traditional 3D printer G-code generating logic to three different methods

## WORK EXPERIENCE

---

- Research Assistant**, UM-SJTU Joint Institute, Bio-inspired Fluid Mechanics lab *Jan 2022 - Sep 2023*
- Teaching Assistant**, UM-SJTU Joint Institute *2022 - Present*
- VM312, Mechanical Behaviour of Biological Tissues
  - VM250, Design and Manufacturing 1
  - VG100, Introduction to Engineering

## SKILLS

---

**Programming:** MATLAB, C, C++, Python  
**Softwares & Tools:** SOLIDWORKS, LaTeX, COMSOL, Origin, Arduino, LabVIEW, Adobe Illustrator  
**Biorelated skills:** Bacteria culturing

## AWARD & APPOINTMENT

---

- Co-founder and co-leader of ASME branch in UM-SJTU Joint Institute *Sep 2022 - Present*
- Outstanding Graduates of Shanghai (top 3% out of 350) *2023*
- Capstone Project Gold Award at the UM-SJTU JI Design Expo (top 5% out of 50) *2023*
- ChunTsung Scholar (top undergraduate research program in SJTU) *2023*
- The John Wu & Jane Sun Merit Scholarship (top 3% out of 300) *2022*
- First Prize of Shanghai Mechanical Engineering Innovation Competition *2021*