

**Yunfan Huang 黄云帆, Doctor of Philosophy**

Department of Engineering Mechanics, Tsinghua University

**Date of Birth:** 1997/03**Websites:** [ResearchGate](#)**Contact Info:** xungeer2311@gmail.com**Education Background**

- |   |  |                                |                     |                                     |
|---|--|--------------------------------|---------------------|-------------------------------------|
| ➤ | 2019/08-2025/07  | <b>Doctor of Philosophy</b>    | Tsinghua University | Department of Engineering Mechanics |
| ■ | <b>Major:</b> Power Engineering and Engineering Thermal Physics (Admission by Recommendation)                                      |                                |                     |                                     |
| ■ | <b>Dissertation:</b> Electrokinetic transport of immiscible liquid-liquid interface ( <b>Supervisor:</b> Prof. Moran Wang)         |                                |                     |                                     |
| ■ | <b>Applications:</b> Enhanced oil recovery with low-salinity waterflooding, Electrolyte filling in rechargeable batteries          |                                |                     |                                     |
| ➤ | 2018/10-2019/01  | <b>Visiting Student</b>        | Purdue University   | School of Mechanical Engineering    |
| ■ | <b>Project:</b> Optimization of the pillar array distribution for rare cell analysis ( <b>Supervisor:</b> Prof. Steven T. Wereley) |                                |                     |                                     |
| ■ | <b>Applications:</b> Reaction efficiency enhancement in point-of-care fluidics for rare cell analysis                              |                                |                     |                                     |
| ➤ | 2015/08-2019/07  | <b>Bachelor of Engineering</b> | Tsinghua University | Department of Engineering Mechanics |
| ■ | <b>Major:</b> Theoretical and Applied Mechanics (Tsien Excellence in Engineering Program, TEPE; Ranked 6/29)                       |                                |                     |                                     |
| ■ | <b>Thesis:</b> Electron hydrodynamics in micro/nanoscale low-dimensional materials ( <b>Supervisor:</b> Prof. Moran Wang)          |                                |                     |                                     |
| ■ | <b>Applications:</b> Super-ballistic electron transport in 2D materials, Thermal management of electronic devices                  |                                |                     |                                     |

**Research Experiences*****Research Interests***

- Physicochemical hydrodynamics at micro-/nano-scale, e.g., electrokinetic transport
- Quantum hydrodynamics in solids, e.g., electron, phonon, ...
- Kinetic modeling and multiscale simulation of multiphysical transport

***Research Projects*****Main: electrokinetics at liquid-liquid interface, electron hydrodynamics**

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|---|---|--|---------------------|
| ➤ | 2019-2025   | <b>Doctoral dissertation</b> , also supported by NSFC & NKRD       | Tsinghua University |
| ■ | Project: Electrokinetic multiphase flow in porous media & Multiphysical microflow simulation software |  |                     |
| ➤ | 2017-2019   | <b>Bachelor's thesis</b> & Open Research for Innovative Challenges | TEEP                |
| ■ | Project: Mechanism of electron transport in two-dimensional materials based on electron hydrodynamics |  |                     |

***Supplement***

- |   |   |   |                          |
|---|---|---|--------------------------|
| ➤ | 2021/07-08  | Internship (in Company)                           | DORIGHT                  |
| ■ | Project: Review and simulation of flow and heat transfer in a high-temperature air preheater with helical baffles |   |                          |
| ➤ | 2018-2019   | Senior Undergraduate Research Fellowship          | Purdue University - TEEP |
| ■ | Project: Optimization of the pillar array distribution for rare cell analysis in point-of-care diagnostics        |   |                          |
| ➤ | 2018/07-08  | Internship (in Institute)                         | Beijing CSRC             |
| ■ | Project: Implementation of Zoltan interface for mesh partitioning in high-precision CFD software                  |   |                          |
| ➤ | 2017-2018   | Advanced Placement Course (Finite element method) | TEEP                     |
| ■ | Project: Development of complex elements & multifunctional finite element programs for cable-stayed bridges       |   |                          |

***Possible Engagement***

- **Physico-chemical hydrodynamics:** electrochemical energy conversion, soft matter, collective behavior of living matter
- **Quantum hydrodynamics in solids:** vortex hydrodynamics in electron transport, odd viscosity of electron fluid

## **Other Experiences**

### ***Academic Skills***

- **Theoretical kinetic modeling**: electron-phonon transport in solids, ion-fluid coupling transport in electrolyte solutions
- **Algorithm development**: particle mesoscopic methods (LBM), PDE solvers (DOM, FVM/FEM); in Matlab/Fortran/C
- **Numerical simulation**: COMSOL, ANSYS Fluent, ABAQUS, OpenFOAM; AutoCAD, SolidWorks, Origin, ParaView
- **Experiment platform setup**: microfluidic measurement system, including design, fabrication, test and data processing
- **Engineering system design**: optimization of complex bridge / heat exchangers, electrical and control system in CMG

### ***Academic Experiences***

- 2021-2023/Fall, **Teaching Assistant** of *Heat and Mass Transfer* (Prof. Moran Wang), Tsinghua University
- 2018/07, Participant (1/40) in **Airbus Airnovation Summer Academy**, Cranfield University (UK)

### ***Social Practices and Hobbies***

- 2020/11, **Technology Industry Survey** of Hangzhou, TEEP, Tsinghua University
- 2017-2018/Winter, **Industrial Survey** of Hong Kong/Singapore, Student Association for Sci & Tech, Tsinghua University
- **Hobbies**: Music (Violin, Piano, Chorus), Sports (Badminton, Table tennis), Reading (Sci-Fi, Sci-Tech history)

## **Honors & Awards**

### ***In Research+***

- 2024.08 Tsinghua Doctoral Travel Grant for International Conferences (Top-Tier)
- 2021.12 Tsinghua Comprehensive Excellence Scholarship (1<sup>st</sup> Prize)
- 2019.07 Tsinghua “Future Scholar” Scholarship
- 2019.07 Bachelor’s Thesis with Honor (both in Tsinghua, and in Beijing)
- 2018.02 Honorable Mention in the Mathematical Contest in Modeling (MCM, held by SIAM)

### ***In Education+***

- 2025.06 Beijing Outstanding Graduate (Ph.D.)
- 2023.12 Excellent Teaching Assistant (in Dept.)
- 2021.12 Tsinghua Excellent Mentor for Undergraduate
- 2019.07 Tsinghua Outstanding Graduate (B.E.)
- 2016.10 National Scholarship
- 2015.10 Tsinghua Xuetao Scholarship (Outstanding Innovative Talent Cultivation Program)

## **Supplemental materials**

### ***A. Publication Lists***

### ***B. Intellectual Property Rights***

## **A. Publication Lists**

### ***Journal papers (topical review)***

1. **Y.F. Huang** and M. Wang\*. Electrokinetics at liquid-liquid interfaces: Physical models and transport mechanisms. *Advances in Colloid and Interface Science*, **342**: 103518, 2025.
2. **Y.F. Huang** and M. Wang\*. Electrokinetic multiphase hydrodynamics. *Applied Physics Reviews*, *In Press*, 2025.
- ✧ **Y.F. Huang**, Z.G. Tian, H.Y. Chen, W. Liu, M. Wang\*. Electrokinetic transports in saturated and unsaturated porous media. *Advances in Colloid and Interface Science*, 2025. *Under review*

### ***Journal papers (research - (co-)first author)***

3. **Y.F. Huang** and M. Wang\*. Solvent mixing and ion partitioning effects in spontaneous charging and electrokinetic flow of immiscible liquid-liquid interface. *Physical Review Fluids*, **9**: 103701, 2024 (Highlighted as **Editors' Suggestion**)
4. A. Alizadeh<sup>#</sup>, **Y.F. Huang**<sup>#</sup>, F.L. Liu, H. Daiguji, M. Wang\*. A streaming-potential-based microfluidic measurement of surface charge at immiscible liquid-liquid interface. *International Journal of Mechanical Sciences*, **247**: 108200, 2023
5. X. Ran<sup>#</sup>, **Y.F. Huang**<sup>#</sup>, M. Wang\*. A hybrid Monte Carlo-discrete ordinates method for phonon transport in micro/nanosystems with rough interfaces. *International Journal of Heat and Mass Transfer*, **201**: 123634, 2023
6. **Y.F. Huang** and M. Wang\*. Nonnegative magnetoresistance in hydrodynamic regime of electron fluid transport in two-dimensional materials. *Physical Review B*, **104**: 155408, 2021
- ✧ **Y.F. Huang** and M. Wang\*. Electrokinetic transport regulation at liquid-infused surface by liquid depletion and ion partition. *Physical Review Fluids*, 2025. *In revision (Minor revision)*
- ✧ **Y.F. Huang** and M. Wang\*. Electrophoresis of charged dielectric droplet with ion concentration polarization effect. *Physical Review Fluids*, 2025. *Under review*

### ***Journal papers (research - others)***

7. M.B. Zhang, Z.G. Tian, **Y.F. Huang**, M. Wang\*. Gas flow regimes and transition criteria in porous media. *Physical Review Fluids*, **10**: 024303, 2025
8. W. Liu, **Y.F. Huang**, M. Wang\*. Extended space charge and transport near ion-selective surfaces. *International Journal of Mechanical Science*, **287**: 109933, 2025
9. Z.G. Tian, **Y.F. Huang**, M. Wang\*. Analytical solution of inertia effect in high-speed flows through disordered porous media. *Physical Review Fluids*, **9**: L102101, 2024
10. Q.Q. Li, G. Yang, **Y.F. Huang**, X.K. Lu, J. Min and M. Wang\*. Lattice Boltzmann method for particulate multiphase flow system. *International Journal of Mechanical Sciences*, **273**: 109217, 2024
11. Y.R. Li, **Y.F. Huang**, X.K. Lu, M. Wang\*. Criteria of distribution transitions in dispersed multiphase systems based on an extended lattice model. *Langmuir*, **39**: 17021, 2023
- ✧ W. Liu, **Y.F. Huang**, M. Wang\*. Instability and scaling transition near strongly polarized surfaces. 2025. *Journal of Fluid Mechanics*, *Under review*
- ✧ X.K. Lu, Q.Q. Li, G. Yang, **Y.F. Huang**, M. Wang\*. Inertial accumulation effect on particle transport and preferential flow control in porous media. *Physical Review Fluids*, 2025 *Under review*

### ***Journal papers (in Chinese)***

12. **Y.F. Huang**, M. Wang\*. Merging of mechanics and mathematical physics: A brief discussion on similarity method. *Mechanics in Engineering*, **46**: 868-875, 2024 [in Chinese]
13. **Y.F. Huang**. Relationship between the two loci of instant center of rigid body in plane motion. *Mechanics in Engineering* **3**: 306, 2017 [in Chinese]
14. B. Liu, **Y.F. Huang**, M. Wang\*. Physics and modeling of phonon wave behaviors in nanoscale heat conduction. *Chinese Journal of Computational Physics*, **41**: 746, 2024 [in Chinese]
- ✧ **Y.F. Huang** and M. Wang\*. Electrokinetics at liquid-liquid interfaces: Mechanisms and applications. *Chinese Journal of Theoretical and Applied Mechanics*, 2025. *In revision (Minor revision)* [in Chinese]

### ***Conferences***

1. **Y.F. Huang**, M. Wang\*. Ion concentration polarization effect in electrophoresis of highly charged dielectric droplet (Oral). *CCTAM 2025*. Changsha, China. 2025.08. *Accepted* [in Chinese]
2. **Y.F. Huang**, W. Liu, M. Wang\*. Electrokinetic multiphase flow at spontaneously charged liquid-liquid interface: a diffuse interface model with adsorption-induced interface charge (Oral & Long abstract). *ICTAM 2024*. Daegu, Korea. 2024.08
3. **Y.F. Huang**, A. Alizadeh, F.L. Liu, M. Wang\*. Measurement of surface charge at immiscible liquid-liquid interface using streaming-potential-on-microfluidics (Oral). *InterPore 2023*. Edinburgh, UK. 2023.05
4. **Y.F. Huang**, M. Wang\*. Measurement of liquid-liquid interfacial charge based on streaming potential (Oral). *NCFIuid 2022*. Xi'an, China. 2022.11 [in Chinese]
5. **Y.F. Huang**, M. Wang\*. Hydrodynamics of low dimensional electron transport at micro-nanoscales (Oral & Paper). *CCTAM 2019*. Hangzhou, China. 2019.08 [in Chinese]

## **B. Intellectual Property Rights**

### ***Patents (in Chinese)***

1. M. Wang, **Y.F. Huang** and F.L. Liu. A method and apparatus for measuring the charge density at the liquid-liquid interface, patent number ZL 2021 1 1448254.6, authorization number CN 114216950 B, 2024.
2. M. Wang, **Y.F. Huang**. A method, device, and system for in-situ measurement of the charge density at the immiscible liquid interface, patent number ZL 2025 X XXXXXXXX.X, authorization number CN XXXXXXXXXX B, 2025. (*In Process*)

### ***Software copyrights (in Chinese)***

3. M. Wang, G. Yang, H.Y. Chen, and **Y.F. Huang**. Multi-physics, multi-phase, multi-scale flow simulation software ( $\mu^3$ -Flows), registration number 2024SR0160474, 2024.