Hanfeng Zhai

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372 Upson Hall, Cornell University | *124 Hoy Rd., Ithaca, NY 14850, USA*

Education

Cornell University — Ithaca, NY
M.S. in Mechanical Engineering — *Aug. 2021 – June 2023*
Thesis: TBD — Advisor: *Jingjie Yeo*

Shanghai University — Shanghai, China
B.S. in Theoretical and Applied Mechanics (*Outstanding Graduate of Shanghai*) — *Sep. 2017 – July 2021*
Thesis: *Predicting microbubble system dynamics with physics-informed deep learning* — Advisor: *Guohui Hu*

Honors & Awards

Global Ranking #27 — Independent Attendee
DARPA Forecasting Floats in Turbulence (FFT) Challenge — *Dec., 2021*
Outstanding Project Presentation Award — Project Principal
National College Student Innovation and Entrepreneurship Annual Conference — *Oct., 2021*
Outstanding Undergraduate Thesis Award — Independent Award
Shanghai University — *July, 2021*
Outstanding Graduate of Shanghai — Independent Award
Shanghai Ministry of Education — *May, 2021*
Second Class Award — Independent Award
The 3rd Undergraduate Academic Forum of Shanghai University — *Dec., 2020*
Top Class Academic Scholarship — Independent Scholarship
Shanghai University — *Nov., 2020*
Arts and Sports Scholarship — Independent Scholarship
Shanghai University — *Nov., 2020*
Outstanding Undergraduate Course Project — Team Lead
School of Mechanics and Engineering Science, Shanghai University — *Dec., 2019*
First Place Award & Third Place Award — Independent Award
Shanghai University Body Building Contest, Shanghai University Sport Committee — *Apr., 2018 & Apr., 2019*
Athletic Scholarship — Independent Scholarship
Shanghai University — *Nov., 2018*
Outstanding Student & Team Project Award — Independent Award & Team Member
Bank of China Life, IBEP Financial Planning Competition — *Feb., 2018*
Outstanding Student Nomination (×2) — Independent Award
Shanghai University — *July, 2018 & Dec., 2020*

Research Experiences

Summer Research Intern — Beijing, China
Institute of Mechanics, Chinese Academy of Sciences; *Supervisor: Xu Zheng* — *May 2021 – Aug 2021*
- Fabricated Janus micromotors, designed (with Prof. Zheng) and conducted (with Dr. Wang) the experiments on Janus particles in viscoelastic fluids.
- Analyzed the non-equilibrium behavior of Janus particles. Discovered the transnational and rotational diffusion of Janus motors in non-Newtonian fluids.

Research Assistant — Shanghai, China
Shanghai Institute of Applied Mathematics and Mechanics; *Supervisor: Guohui Hu* — *May 2020 – July 2021*
- Designed and carried out bubbly flows numerical simulations with biomedical backgrounds in microscale with COMSOL Multiphysics®.
- Initiated and proposed BubbleNet, a novel deep learning framework for inferring bubble dynamics with physics-informed neural networks, and open the project on GitHub [4]. Preprint available [5].

Summer Research Intern — Shanghai, China
Shanghai University; *Supervisor: Bingbing An* — *Jun. 2020 – Aug. 2020*
- Conducted numerical study of fatigue and fracture in biomimetic and biomaterials on dentin microstructure based on SEM photo from literature.
- Study and show that the plasticity properties of the peritubular dentin structure can effectively resist crack growth of the dentin based on numerical simulations. [Report]

Research Assistant SHANGHAI & SEATTLE (Remote)
Shanghai University & University of Washington; *Supervisor: Dwayne D. Arola* *Sep. 2019 – Mar. 2020*

- Carried out research in Arola Lab on enamel microstructure fracture resistance investigation and found that the band decussation can effectively resist fracture. [Project Page]
- Writing tech reports and doing presentations directly or remotely with the project principal Dwayne D. Arola.
- Carrying simulations and numerical analysis with Abaqus CAE & MATLAB (with S. Liu & B. An) based on the SEM photo of enamel microstructure to analyze the mechanical properties of enamel microstructure.
- Building models of enamel microstructure in 3D with SOLIDWORKS, manufacturing the unit cell with 3D printing.

SELECTED PROJECTS

(8) W. Hintlian, M.P. Bergs, **H. Zhai**, M. Haji†. *TherMaG: Engineering Design of Thermo-Magnetic Generator with Multidisciplinary Design Optimization*. (2021).

(7) **H. Zhai**, G. Hu†. *BubbleNet: Deep learning framework for predicting bubble dynamics*. (2021).

(6) S. Liu, **H. Zhai**, Y. Xu, B. An†, D. Zhang†, D.D. Arola†. *The role of rod decussation on crack deflection in enamel*. (2020).

(5) **H. Zhai**, B. An†. *Structural design of composite materials with superior mechanical behaviors: lesson from the microstructure of nacre and enamel*. (2019 - 2020).

(4) **H. Zhai**, J. Zhang†. *Thermal Estimation of Smartphone Chipset: Mechanical Distribution of Chipset in Multiphysics Field*. (2020).

(3) **H. Zhai**, S. Diao, S. Weng, K. Li†. *Design of Intelligent Tuning Equipment for Stringed Instruments*. (2019 - 2020).

(2) **H. Zhai**, K. Wang, Z. Liu, R. Alam†. *An optimized algorithm for the prediction of the water emptying time on BPNN*. (2020).

(1) **H. Zhai**, B. An†. *An investigation of the elastoplastic nature of ITD on the toughness of the dentin microstructure*. (2020).

PUBLICATION

[1] **H. Zhai**, Q. Zhou and G. Hu*. (2021) "BubbleNet: Inferring micro-bubble dynamics with semi-physics-informed deep learning". *arXiv preprint*. arXiv:2105.07179.

RESEARCH PRESENTATIONS

[1] **Computation Methods for Applied Mechanics Problem.** *The 3rd Undergraduate Academic Forum of Shanghai University*. Dec. 30th, 2020. [Poster] [Paper] [News]

EXTRACURRICULAR ACTIVITIES

- **Scientific Editor** for QbitAI.com (Winter 2021). My articles on programmable meta-materials, physics-informed deep learning, etc., reached 25600+ reads, with 150+ likes (June, 2021), which can be viewed at [1], [2], [3], [4], [5].
- **Student Athlete** at China University American Football League (CUAFL). Played Defensive End & Linebacker at *Shanghai University Bombers American Football Team* (2017 – 2019), won 3rd place twice in 2017 – 2018 & 2018 – 2019 seasons [Interview]. Joined Russell Wilson football training camp as a DB. (July, 2018) [Media Coverage].
- **Member** of the Shanghai University Tulip Investment Club (2017 – 2018). Won Team Award & Outstanding Student at Financial Planning Competition hosted at Bank of China Life.
- **Member** of the Shanghai University Bodybuilding Contests (2017 – 2019). Won 1st & 3rd place in Shanghai University 2018 & 2019 Bodybuilding contest.

TECHNICAL SKILLS

Coding & Programming: Python, MATLAB & Octave, Mathematica, C++, HTML, LaTeX, Bash, MPI, TensorFlow.
Computer Systems: Ubuntu, macOS, Windows 7 & 10.
Simulation Softwares: COMSOL Multiphysics, LAMMPS, ANSYS workbench & APDL, Simulink, Abaqus CAE.
Knowledge & Theories: Computational Fluid Dynamics, Fluid & Solid Mechanics, Dynamics System & Nonlinear Control, Structural Mechanics, Machine Learning & Deep Learning, Engineering Optimization, etc.

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†Supervisor
*Corresponding author