



HANFENG ZHAI

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School of Mechanics and Engineering Science, Shanghai University

SUMMARY

Bachelor student currently studying at Shanghai University. Enthusiastic about both Solid and Fluid Mechanics. Engaged in research projects ranging from the **Investigations of Bio-inspired Structured Materials** to **Numerical Studies of Fluid Mechanics**. Having a passion for learning the most cutting-edge knowledge and exploring the world of **Mechanics** and **Engineering**. An aficionado of sports, notably **American Football** and **Bodybuilding**.

EDUCATION

Shanghai University – Department of Mechanics

SHANGHAI, CHINA

B.Eng. in Theoretical and Applied Mechanics

Sep.2017 – Aug.2021

Main modules taken: Solid and Fluid Mechanics, Physics, Engineering Mathematics, and CAE Simulations.

GPA: 3.43/4.0 (86.53/100) **Major GPA:** 3.60/4.0 (88.47/100) **Ranking:** 6/28 (21.4%)

- 87/100 (3.7/4.0) in course *Ordinary Differential Equation*
- 93/100 (4.0/4.0) in course *Mathematical Physics Method II*
- 100/100 (4.0/4.0) in course *Mechanics of Materials II*
- 86/100 (3.7/4.0) in course *Experiment of Fundamental Mechanics A*
- 89/100 (3.7/4.0) in course *Numerical Methods in Science and Engineering*
- A (4.0/4.0) in program *SHU Summer CAE Internship Program, 2019*
- 100/100 (4.0/4.0) in course *Fluid Mechanics I*
- 87/100 (3.7/4.0) in course *Mechanics of Elasticity I*
- 98/100 (4.0/4.0) in course *Applications of Finite Element Method*
- 97/100 (4.0/4.0) in course *Experimental Mechanics*
- 97/100 (4.0/4.0) in course *Fluid Mechanics II*
- 87/100 (3.7/4.0) in course *Structural Mechanics*
- 95/100 (4.0/4.0) in course *Mechanics of Elasticity II*
- 97/100 (4.0/4.0) in course *Machine Learning and Mechanics*
- 91/100 (4.0/4.0) in course *Senior Dynamics*
- 86/100 (3.7/4.0) in course *Plasticity Theory*
- 90/100 (4.0/4.0) in course *CAD Applications in Structural Mechanics*
- A (4.0/4.0) in course *Fatigue and Fracture*
- A (4.0/4.0) in course *Research Methods (Fluid Physics on Flight)*

Honors & Awards

Outstanding Student Nomination

July.2018

Awarded by wide-ranged interests from sports to investment, with good academic performance. The award provide extra credits and the priority to choose the major.

Shanghai University Athletic Scholarship

Nov.2018

¥500 awards. Name-list available on <http://www.xgb.shu.edu.cn/info/1003/8299.htm> (2:87)

RESEARCH EXPERIENCES

1 Aircraft Noise Prediction Based on Machine Learning and Statistics (“Internet Plus”

Manufacturing Project)

Supervisor: Guohui Hu; **Project Member**

July.2020 – present

- Applying statistical and machine learning algorithms i.e. decision tree, SVM, BPNN to predict the airfoil noise based on experimental database of aircraft.
- Optimize the algorithm through the Lucky-Draw algorithm and ARMA algorithm.

- Project details available on <https://cy.ncss.cn/search/8a80808b733233d60173338117242a9c>

2 An Investigation of the Elastoplastic Nature of Dentin's ITD in the High Toughness of the Dentin Microstructure (SHU Summer Research Project)

Supervisor: Bingbing An; Independent Study

July.2020 – Aug.2020

- Find that the plastic nature of the dentin's ITD help reduce stress concentration and thence resist crack growth on dentin's microstructure through studying the stiffness of the composite structure and the crack propagation process.
- Unveil the ITD's perfect plastic model does not contribute much on the debonding effect between the ITD and PTD.
- The scientific report is available on DOI: [10.13140/RG.2.2.23495.93605](https://doi.org/10.13140/RG.2.2.23495.93605)

3 An Optimized Algorithm for the Prediction of the Water Emptying Time on BPNN (Fluid Mechanics Online Research Program, UC Berkeley)

Supervisor: Reza Alam; Group Coordinator & Presenter

Jun.2020 – Aug.2020

- Provide an analytical solution based on a simplified model for the water discharge problem with fluid mechanics.
- Discuss feasible experimental methods with the teammates and obtain data of the water discharge experiments.
- Applying simple neural networks model and fluid mechanics knowledge to provide a regression model for the prediction for the water emptying time. The code and supplementary materials on <https://github.com/fzhai0/code>.
- Draft the final report and carry out the presentation. The slides available on DOI: [10.13140/RG.2.2.11974.70728](https://doi.org/10.13140/RG.2.2.11974.70728), and the presentation video on <https://b23.tv/azxTqh>. The scientific report on DOI: [10.13140/RG.2.2.11122.73928](https://doi.org/10.13140/RG.2.2.11122.73928).

4 Investigation of the Mechanics of the Airfoil: Application of Machine Learning in the Noise Prediction of NACA 0012 (Fluid Physics on Flight Course Project)

Supervisor: Yuhong Dong & Xiaoquan Yang; Independent Study

Apr.2020 – June.2020

- Applied linear regression and decision tree and coupled with numerical simulations to make a prediction of the noise of airfoil NACA 0012 with existed database.
- Course available on DOI: [10.13140/RG.2.2.18023.68008](https://doi.org/10.13140/RG.2.2.18023.68008)

5 Structural Design of Composite Materials with Superior Mechanical Behaviors: Lesson from the Microstructure of Nacre and Enamel (CAD Applications in Structural Mechanics Course Project)

Supervisor: Bingbing An; Independent Study

Apr.2020 – June.2020

- Applying mechanical simulations with Abaqus testing mechanical properties of the composite materials inspired by the microstructure of nacre and enamel.
- Designing hierarchical structured material with superior mechanical behaviors based on the structures, which proved to display high stiffness and fracture resistance based on the simulations.
- Course paper available on DOI: [10.13140/RG.2.2.26412.28803](https://doi.org/10.13140/RG.2.2.26412.28803)

6 Formulation and Application of Rate-Independent Stress Update Algorithm of Hydrostatic Pressure: Elastoplastic Yielding in Composite (Plasticity Theory Course Project)

Supervisor: Bingbing An; Independent Study

Apr.2020 – June.2020

- Based on the plasticity theory and the Drucker-Prager yield model, form a stress update algorithm.
- Estimate how the small deflection on the soft matrix will affect the general mechanical behavior of the fiber-reinforced composite applied with the Drucker-Prager model.
- Course paper available on DOI: [10.13140/RG.2.2.36478.61768](https://doi.org/10.13140/RG.2.2.36478.61768)

7 Buckling of a Thin Plate (Elastic Mechanics Course Teaching Experience)

Supervisor: Junqian Zhang; Conductor & Teacher

Apr.2020 – June.2020

- Conducting and presenting an online course with regards to the buckling behavior of thin plate in Elastic Mechanics.
- Answering questions from class students and supervisor J. Zhang.
- Teaching mathematic models and applications of Plate Buckling to the students in the school. The video is available on <https://b23.tv/gXOXNX>

8 Thermal Estimation of Smartphone Chipset: Mechanical Distribution of Chipset in Multiphysics

Field (Elastic Mechanics Course Project)

Supervisor: Junqian Zhang; *Independent Study*

Dec.2019 – Mar.2020

- Calculated the stresses and displacements distribution of smartphone chip based on Multiphysics field and elastic mechanics theory.
- Conducted FEM simulation to compare the results and plotted the related graphical distributions and diagrams.
- Discussed the pros and cons of different battery-chip placements, with different chip materials and provide feasible methods to optimize the design smartphone chip with regards to mechanical properties of the materials.
- Course paper available on DOI: [10.13140/RG.2.2.21379.12326](https://doi.org/10.13140/RG.2.2.21379.12326)

9 Biomechanics Research (Arola Lab, University of Washington)

Supervisor: Dwayne D. Arola & Dongsheng Zhang; *Group Member & Presenter*

Sep.2019 – present

- Assisted with the cutting, polishing and etching of the tooth specimen and got the hang of such experimental skills.
- Collected and organized data by observing SEM photos of biomaterials in Lab.
- Built three-dimensional CAD models of architectural materials after rounds of group discussion.
- Studied the crack resistance of biomaterials based on simulations on finite element method.

10 Design of Intelligent Tuning Equipment for Stringed Instruments (National College Student's Innovation and Entrepreneurship Training Program)

Supervisor: Kai Li; *Project Principal; Item No. #201910280001*

Oct.2019 – present

- Modeled independently the integrated guitar structure, performed string vibration simulation in ANSYS and specified the effect of the guitar resonance cavity on the overall sound quality and the effect of pitch.
- Designed materials and fixtures according to the theoretical model, and settled on fixing the guitar strings by winding welding to minimize the measurement error under tension.
- Recorded accurately the experimental data, including frequency acquisition of recorded sounds with software.
- Instructed teammate to write GUI programs and successfully imported data into mathematical software for spectrum analysis.
- Poster available on: DOI: [10.13140/RG.2.2.28004.81283](https://doi.org/10.13140/RG.2.2.28004.81283) and project details on <http://gjxcxy.bjtu.edu.cn/NewLXItemListForStudentDetail.aspx?ItemNo=422368&year=2019&type=student>

11 Structural Design of Lightweight Compressive Interlayer (Applications of Finite Element Method Course Project)

Supervisor: Yicheng Song; *Group Leader & Presenter*

Sep.2019 – Nov.2019

- Designed a circular arch bridge-like compression structure after literature review and case study, performed basic mechanical analysis on the given structure to design an improved structure, and formed a 3 designs formation along with the given structure for later comparison and contrast.
- Built three models by CAD software and 3D printed them successfully.
- Repeated debugging before added a large metal block plate above the test piece to produce uniform loading, and then carried out loading on the test piece.
- Estimated the results of both experiments and simulations and proposed the best design of compressive interlayer.
- Project was nominated as excelled teamwork, poster exhibited within the School. Poster available on <http://dx.doi.org/10.13140/RG.2.2.15467.77603>

12 Beam Moment & Stress Distribution Calculation Software Development (SHU Summer Intern Project)

Supervisor: Yongqi Ma; *Group Leader*

Jun.2019 – July.2019

- Developed a software using MATLAB calculating the moment and stress distribution along the beam after inputting the parameters, loading, and boundary conditions in the operating interface.
- Details available on <https://github.com/fzhai0/beam-force-calculation>

PUBLICATION

S. Liu, **H. Zhai**, Y. Xu, B. An*, D. Zhang*. The role of rod decussation on crack deflection in enamel. *Journal of the Mechanical Behavior of Biomedical Materials*. **2020** (Under Review)

EXTRACURRICULAR EXPERIENCE

1 Bank of China Group Life Assurance Company

HONGKONG, CHINA

Supervisor: Wong Luk Kwan Calvin; Intern

Feb.2018

- Learning marketing and investment strategy through real-life examples in with virtual investment competition under decent guidance in BOC.
- Promoting financial products to potential customers with introducing the products' potential interests.
- Making presentation about insurance analyzation and recommendations and obtaining recommendation letter from Senior District Director. For more details, please contact ronald_tam@wm-boclif.com.hk

2 Chinese University American Football League (CUAFL)

Shanghai University Football Team (Bombers) Defensive End & Linebacker

Nov.2017 – June.2019

- Skilled in football tackling and played for defensive team for two seasons. Three-Five average tackle per game. Also played as a backup offensive lineman.
- Selected as a defensive player in the Russell Wilson China Football Training Camp and engaged in multiple training conducted by Russell Wilson and his team, who agreed to shot photos with me due to my impressive performance.
- Media coverage on <https://www.americanfootballinternational.com/russell-wilson-wraps-up-china-tour-reflects-on-football-growth/> (HZ is #0 in the right part wearing brown jerseys, in the last photo.)

3 Shanghai University Bodybuilding Club

Member and Prize Winner

Apr.2018 – May.2019

- Won the 1st place in 2018 Shanghai University Bodybuilding Contest and 3rd place in 2019 Shanghai University Bodybuilding Contest.

SKILLS SUMMARY

Languages

English, Chinese (Native), German (Preliminary: {SHU-Elementary German (1): 96 / 100 (4.0 / 4.0)}).

Software

Numerical: MATLAB, Python, Origin Pro, C programming, HTML.

Modelling: AutoCAD, SOLIDWORKS.

Simulation: Abaqus, Ansys (APDL & workbench), COMSOL (learning).

Figure: Inkscape, Pixelmator Pro.

Basic: Microsoft Office (Word, Excel, PowerPoint, OneNote, etc.) & Apple office software (Pages, Numbers, Keynote, etc.)

REFERENCES

- Dwayne D. Arola, Ph.D., Associate Professor, University of Washington. For more details: darola@uw.edu
- Reza Alam, Ph.D., Associate Professor, University of California, Berkeley. For more details: reza.alam@berkeley.edu
- Junqian Zhang, Ph.D., Professor, Shanghai University. For more details: jqzhang2@shu.edu.cn
- Guohui Hu, Ph.D., Professor, Shanghai University. For more details: ghhu@staff.shu.edu.cn
- Dongsheng Zhang, Ph.D., Professor, Shanghai University. For more details: donzhang@staff.shu.edu.cn
- Zhansheng Guo, Ph.D., Professor, Shanghai University. For more details: davidzsguo@shu.edu.cn