

# HANFENG ZHAI

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## EDUCATION

Shanghai University, Shanghai, China

09/2017-06/2021

**Major:** Theoretical and Applied Mechanics (Bachelor of Science)

**GPA:** 3.44/4.0 (86.65/100); **Major GPA:** 3.6/4.0 (88.47/100); **Ranking:** 6/28 (21.4%)

### Honor & Awards:

Outstanding Student Nomination	07/2018
Shanghai University Athletic Scholarship	11/2018
Shanghai University Academic Scholarship (Top Class)	11/2020
Shanghai University Arts and Sports Scholarship	11/2020
Outstanding Student Nomination	12/2020
The Third Undergraduate Academic Forum Best Paper Award (STEM II Division)	01/2021

## PUBLICATION

S. Liu, H. Zhai, Y. Xu, B. An\*, D. Zhang\*. "The Role of Rod Decussation on Crack Deflection in Enamel". Contributed to *Biomechanics and Modeling in Mechanobiology*. 2020 (Under Review)

## PRESENTATION

H. Zhai. "Computation Methods for Applied Mechanics Problem". *The Third Undergraduate Academic Forum*, Shanghai University, Shanghai, China. Dec. 30<sup>th</sup>, 2020. ([News](#)) ([Paper](#)) ([Poster](#))

## RESEARCH EXPERIENCES

(Details visit [here](#))

**An Investigation of the Elastoplastic Nature of Dentin's ITD in the High Toughness of the Dentin Microstructure** (*SHU Independent Summer Research Project*) 07/2020-08/2020

*Supervisor:* Bingbing An

- Found that the plastic nature of the dentin's ITD helps 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 through comparing a perfect plastic ITD with pure elastic ITD's loading stresses and strain distribution.
- Unveiled the ITD's perfect plastic model failed to contribute much to the debonding effect between the ITD and PTD.
- Scientific Report on [DOI: 10.13140/RG.2.2.23495.93605](https://doi.org/10.13140/RG.2.2.23495.93605).

**An Optimized Algorithm for the Prediction of the Water Emptying Time on BPNN** (*Fluid Mechanics Online Research Program, UCB*) 06/2020-08/2020

*Supervisor:* Reza Alam; *Personal Role:* Group Coordinator & Presenter

- Provided an analytical solution based on a simplified model for the water discharge problem with fluid mechanics.
- Stabilized the bottle with ruler to discharge water and obtained input data e.g. bottleneck diameter, bottle body shape, bottle volume, etc. and output data e.g. water emptying time.
- Applied back-propagation neural network running with a loop to select the NN that satisfied the accuracy standard and fluid mechanics knowledge to provide a regression model for the prediction for the water emptying time; code and supplementary materials on <https://github.com/hanfengzhai/WaterDischargeNN>.
- Drafted the final report and carried out the presentation; the slides on [DOI: 10.13140/RG.2.2.11974.70728](https://doi.org/10.13140/RG.2.2.11974.70728), the presentation video on <https://b23.tv/azxTqh>, and the scientific report on [DOI: 10.13140/RG.2.2.11122.73928](https://doi.org/10.13140/RG.2.2.11122.73928).

**Structural Design of Composite Materials with Superior Mechanical Behaviors: Lesson from the Microstructure of Nacre and Enamel** (*CAD Applications in Structural Mechanics Course Project*) 04/2020-06/2020

*Supervisor:* Bingbing An

- Applied mechanical simulations with Abaqus testing mechanical properties of the composite materials inspired by the microstructure of nacre and enamel.
- Designed 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 on [DOI: 10.13140/RG.2.2.26412.28803](https://doi.org/10.13140/RG.2.2.26412.28803).

**Thermal Estimation of Smartphone Chipset: Mechanical Distribution of Chipset in Multiphysics Field** (*Elastic Mechanics Course Independent Project*) 12/2019-03/2020

*Supervisor:* Junqian Zhang

- 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, e.g. the displacement being not uniformly distributed along the y axis, the deformed shape of the chip being kindred to a trapezoid, etc. with different chip materials and provided feasible methods to optimize the design smartphone chip with regards to mechanical properties of the materials.
- Course paper on [DOI: 10.13140/RG.2.2.21379.12326](https://doi.org/10.13140/RG.2.2.21379.12326).

#### **Biomechanics Research** (*Arola Lab, University of Washington*)

09/2019-Present

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

- 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.

#### **Design of Intelligent Tuning Equipment for Stringed Instruments**

(*National College* 10/2019-08/2020)

*Student Innovation and Entrepreneurship Project*

**Supervisor:** Kai Li; **Personal Role:** Group Leader; Item No. #201910280001

- 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 with GUI programs and successfully imported data into MATLAB and Origin Pro for spectrum analysis.
- Poster on: [DOI: 10.13140/RG.2.2.28004.81283](https://doi.org/10.13140/RG.2.2.28004.81283); project details on <http://gjxcxy.bjtu.edu.cn/NewLXItemListForStudentDetail.aspx?ItemNo=422368&year=2019&type=student>

#### **Structural Design of Lightweight Compressive Interlayer** (*Applications of Finite Element Method*

09/2019-11/2019

*Course Project*)

**Supervisor:** Yicheng Song; **Personal Role:** Group Leader & Presenter

- 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 nominated *Excelled Teamwork*; poster exhibited on-campus: <http://dx.doi.org/10.13140/RG.2.2.15467.77603>.

#### **EXTRACURRICULAR ACTIVITIES**

##### **Bodybuilding Club, Member and Prize Winner**

04/2018-05/2019

- Won 1<sup>st</sup> Place twice and 3<sup>rd</sup> place once in Shanghai University Bodybuilding Contest.

##### **Chinese University American Football League (CUAFL)**

11/2017-06/2019

*Shanghai University Football Team Member Defensive End & Linebacker*

- Played for defensive team for two seasons due to skillful football tackling; three-five average tackle per game; played as a backup offensive lineman.
- Acted as a defensive player in the Russell Wilson China Football Training Camp, and engaged in multiple trainings conducted by Russell Wilson and his team and left him a deep impression.

#### **PROFESSIONAL SKILLS**

##### **Computer Skills:**

**Coding:** MATLAB, Python, C programming, HTML, LaTeX.

**Numerical:** MATLAB, Origin Pro.

**Simulation:** Abaqus, Ansys (APDL & workbench); AutoCAD, SOLIDWORKS (Modeling).

**Figure:** Inkscape, Pixelmator Pro, MATLAB, matplotlib.