

# Zenghao ZHU

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## RESEARCH EXPERIENCE

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| Current<br>SEPTEMBER 2019        | <b>Postdoctoral Scholar</b><br><i>Dept. of Otolaryngology-Head &amp; Neck Surgery, Stanford University</i><br>Computational modeling of hair bundle mechanics in hearing and balance organs.  |
| SEPTEMBER 2019<br>SEPTEMBER 2014 | <b>Graduate Research Assistant</b><br><i>Villanova University</i><br>Used an integrated experimental, analytical and numerical approach to model and analyze the fluid transport in porous media. Extending the knowledge of fluid mechanics in porous media; exploring the primary functions of the porous structures in biological systems; applying the porous media in the field of tribology, filtration, and sports sciences. |
| JUNE 2015<br>SEPTEMBER 2012      | <b>Graduate Research Assistant</b><br><i>University of Shanghai for Science and Technology</i><br>Established a novel measurement for 2-D high-temperature field in combustion by using a CCD camera. Observed the vortex field and coherent structures in jet flow.  |
| JUNE 2012<br>SEPTEMBER 2008      | <b>Undergraduate Research Assistant</b><br><i>China Jiliang University</i><br>Analyzed the stability of 2-Dimensional Burnett equation.   |

## EDUCATION

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| SEPTEMBER 2019 | <b>Doctor of Philosophy</b> , Major: Mechanical Engineering<br>Villanova University(VU), PA   Advisor: Dr. Qianhong WU<br>Certificate: "Teaching Engineering in Higher Education" |
| JUNE 2015      | <b>Master of Engineering</b> , Major: Power Engineering<br>University of Shanghai for Science and Technology (USST), China<br>Advisor: Dr. Xiaoshu CAI                            |
| JUNE 2012      | <b>Bachelor of Engineering</b> , Major: Thermal Energy and Power Engineering<br>China Jiliang University (CJLU), China  |

## PUBLICATIONS AND PRESENTATIONS

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### Journal Papers

- J16 **Zhu, Z.**, and Wu, Q. Fiber orientation in soft porous lubrication [J], *Physics of Fluids*, 2019 (In Submission).
- J15 **Zhu, Z.**, and Wu, Q. Permeability in oriented fibrous porous media [J], *Tribology International*, 2019 (In Submission).
- J14 Wang, Q., **Zhu, Z.** and Wu, Q. A comprehensive experimental and analytical study on the mesoscale porous indentation [J], *Applied Physics Letters*, 2019 (In Submission).
- J13 **Zhu, Z.**, and Wu, Q. On the gravity-driven sliding motion of a planar board on a tilted soft porous layer [J], *Tribology Letters*, 2019, 67.4: 126.
- J12 **Zhu, Z.**, Nathan, R. and Wu, Q. Multi-scale soft porous lubrication[J], *Tribology International*, 2019, 137: 246-253.

- J11 Wang, Q., **Zhu, Z.**, Nathan, R. and Wu, Q. On the study of fluid flow in a soft porous media using a scaled-up indenter[J], *European Journal of Mechanics-B/Fluids*, 2019, 76: 332-339.
- J10 **Zhu, Z.**, Weinbaum, S. and Wu, Q. Experimental study of soft porous lubrication [J], *Physical Review Fluids*, 2019, 4: 024305.
- J09 **Zhu, Z.**, Nathan, R. and Wu, Q. An experimental study of the lubrication theory for highly compressible porous media, with and without lateral leakage[J]. *Tribology International*, 2018, 127:324-332.
- J08 **Zhu, Z.**, Wang, Q. and Wu, Q. On the Examination of the Darcy Permeability of Fibrous Porous Media; New Correlations[J], *Chemical Engineering Science*, 2017, 173: 525-536.
- J07 Gacka, T., **Zhu, Z.**, et al. From red cells to soft lubrication, an experimental study of lift generation inside a compressible porous layer[J], *Journal of Fluid Mechanics*, 2017, 818: 5-25.
- J06 **Zhu, Z.**, et al. Online measurement of 2D temperature field for high-temperature radiation source based on emissivity and radiation intensity[J], *Journal of Chinese Society of Power Engineering*, 2014 34(2): 122-127. (In Chinese)
- J05 **Zhu, Z.**, Zhou, W., and Cai, X. Image Visualization of Microstructures in the Entrainment of Jet Flow by using SFSEI Method[M]//*Particle Science and Engineering*. 2014: 154-158.
- J04 Bao, F., **Zhu, Z.**, Lin J.. Linearized stability analysis of two-dimension Burnett equations[J]. *Applied Mathematical Modelling*, 2012, 36(5): 1902-1909.
- J03 Wei, S., Bao, F., **Zhu, Z.** Linearized stability analysis of two-dimensional Woods-Burnett equations[J]. *Acta Aerodynamica Sinica*, 2012, 30(1): 90-94. (In Chinese)
- J02 Liu, J., Cai, X., **Zhu, Z.** Advancement of Spectral Thermometry for Flames[J]. *Journal of Engineering Thermophysics*, 2013, 12: 042. (In Chinese)
- J01 Liu, J., Cai X.,**Zhu, Z.**, et al. Application of spectral technology in flame measurement[J]. *Frontiers in Energy*, 2014, 8(1): 138.

#### Conference Presentations

- C10 **Zhu, Z.**, Nathan, R. and Wu, Q. A study in multi-scale soft porous lubrication, APS-71st Annual Meeting of the APS Division of Fluid Dynamics, 2018.
- C09 Wu, Q., **Zhu, Z.** and Nathan, R. From Red Cells to Soft Porous Lubrication, 10th International Conference on Porous Media & Annual Meeting, 2018.
- C08 Wu, Q., Wang, Q., Nathan, R. and **Zhu, Z.** On the Pressure Generation and Relaxation in a Porous Media under a Spherical Loading Surface, 10th International Conference on Porous Media & Annual Meeting, 2018.
- C07 Wu, Q., **Zhu, Z.** and Nathan, R. From red cells to soft porous lubrication, APS-70th Annual Meeting of the APS Division of Fluid Dynamics, 2017.
- C06 **Zhu, Z.**, Wang, Q. and Wu, Q. On the examination of Darcy permeability of soft fibrous porous media; New correlations, APS-70th Annual Meeting of the APS Division of Fluid Dynamics, 2017
- C05 Wang, Q., **Zhu, Z.**, Nathan, R., and Wu, Q. On the Pressure Distribution in a Porous Media under a Spherical Loading Surface, APS-70th Annual Meeting of the APS Division of Fluid Dynamics, 2017.
- C04 **Zhu, Z.**, et al. On the Examination of Darcy Permeability a Thin Fibrous Porous Layer, APS -69th Annual Meeting of the APS Division of Fluid Dynamics, 2016.
- C03 Wu, Q., **Zhu, Z.**, et al. From Red Cells to Soft Porous Lubrication, 8th International Conference on Porous Media & Annual Meeting, 2016.
- C02 **Zhu, Z.**, et al. Stability Analysis of Two-dimension Burnett Equations, Recent Progresses in Fluid Dynamics Research, 2011, 1376, 94-96.
- C01 **Zhu, Z.**, et al. Stability analysis of two-dimensional conventional Burnett equations, Chinese Conference of Theoretical and Applied Mechanics, 2011, paper ID: CSTAM2011-E03-0894.

#### Conference Posters

- P02 **Zhu, Z.**, et al. On the Examination of the Darcy Permeability of Soft Fibrous Porous Media; New Correlations, Interpore Annual Conference, 2018.
- P01 **Zhu, Z.** and Wu, Q. A comprehensive study of soft porous lubrication, from red cells to skiing/snowboarding, 2018 International Mechanical Engineering Congress and Exposition (IMECE), 2018.

#### Invited Talk

- T02 **Zhu, Z.**, et al. “From Red Cell to Soft Lubrication, the Study of Lift Generation in Highly Compressible Porous Media”, September Meeting hosted by Society of Tribologists and Lubrication Engineers Philadelphia Section, September 2016.
- T01 **Zhu, Z.**, “Energy, Environment, Sustainability”, VCASE Seminar hosted by Villanova University, 2016.

## AWARDS AND HONORS

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Highest Impact to Underrepresented/Minority Groups <i>International Mechanical Engineering Congress &amp; Exposition, ASME</i>	2019
IMECE Travel Grant <i>International Mechanical Engineering Congress &amp; Exposition, ASME</i>	2019
Villanova University Dissertation Fellowship <i>Villanova University</i>	2018-2019
Third Place Award in 2nd Annual Graduate Engineering Poster Competition <i>College of Engineering, Villanova University</i>	2018
Certificate of Teaching Engineering in Higher Education Practicum <i>Villanova University</i>	2018
University Graduate Research Assistantship <i>Villanova University</i>	2014-2017
Paper Featured on the Cover of the “Journal of Fluid Mechanics” <i>Journal of Fluid Mechanics</i>	2017
STLE Scholarship <i>Society of Tribologists and Lubrication Engineers</i>	2016
“Chen Xuejun” Young Scholar Award <i>Chinese Society of Engineering Thermophysics</i>	2013
First-class Graduate scholarship <i>University of Shanghai for Science and Technology</i>	2013-2014
Outstanding Undergraduate Student <i>China Jiliang University</i>	2012

## OTHER PROFESSIONAL EXPERIENCE

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### Grant Experience

SEPTEMBER 2018	<b>Independently Proposal Writing</b> Seed Funding for Capital Equipment (Pending) Independently wrote a proposal to the “Seed Funding for Capital Equipment” from VU. A novel meso-scale indenter is proposed.
SEPTEMBER 2017	<b>Seed Funding for Capital Equipment (Awarded)</b> Independently wrote a proposal to the “Seed Funding for Capital Equipment” from VU. A novel tribometer is proposed.

2016–Current | **NSF Grant Report Writing**  
Contributed in writing annual progress reports to an NSF grant supported project. The NSF grant number is 1511096.

SEPTEMBER 2014 | **Assistance in NSF Proposal Writing**  
Provided the assistance in writing an NSF grant proposal which has been awarded to advisor Dr. Qianhong Wu. The title of the grant proposal is "Lift Generation in a Functionalized Supra-Molecular Porous Layer, From Red Cells to Super Lubrication." Achieved extensive knowledge of NSF funding agencies and grant submission processes.

## Lab Management

Current | **Lab Manager**  
SEPTEMBER 2014 | *Cellular Biomechanics and Sports Science Lab (VU)*  
Coordinated different research projects among lab members  
Organized lab activities  
Took responsibility in lab facility maintenance  
Performed routine lab safety inspection

## Student Mentoring

MAY 2016 | **Ziran Qi** (Undergraduate, VU)  
JUNE 2015 | **Francis Coen** (Undergraduate, VU)  
Designed a setup for measuring the velocity and pressure distribution in a 3-D printed kidney artery.  
JANUARY 2015 | **Michael Long** (Undergraduate, VU)  
SEPTEMBER 2014 | Performed the experimental study on the macro-scale soft porous lubrication.  
MAY 2014 | **Jingli Chen** (Graduate, USST)  
SEPTEMBER 2013 | Designed a setup for investigating the entrainment structures in jet flow.

## Professional Society Memberships

SEPTEMBER 2018 | American Society of Mechanical Engineers (ASME)  
OCTOBER 2017 | Association of Environmental & Engineering Geologists (AEG)  
NOVEMBER 2016 | American Physics Society (APS)  
SEPTEMBER 2016 | Society of Tribologists and Lubrication Engineers (STLE)

## Journal Referee

Referee for peer-reviewed articles submitted to  
**Physics of Fluids; Journal of Heat Transfer; Advances in Mechanical Engineering; Tribology International**

## KNOWLEDGE AND SKILLS

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- Knowledge** Dynamics, Signal Processing, Porous Media Flow, Permeability Modeling, Fluid Mechanics, Heat transfer, Thermodynamics, Aerodynamics, Biomechanics, Computational Fluid Dynamics (CFD), Data Analysis, Finite Element Analysis (FEA)
- Software** Mathematica, Matlab, Solidworks, AutoCAD, Labview, Fluent, Ansys, Abaqus, Maple, MS office
- Tools** High-speed camera, Thermocouple, Spectrometer, Laser Transmitter, Scanning Electron Microscope (SEM), Microscopy, Motion Control System, Machining, Sensors(Pressure, Load, Flow, Displacement, Temperature)
- Language** English and Chinese

## OUTREACH SERVICE

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- SPRING 2015&18 | **Engineering is for Girls Day**  
*Villanova University*  
This is an annual outreach event “Mechanical Engineering: Solving Problems, Changing Lives” where the Mechanical Engineering Department of Villanova University hosts 80 Girl Scouts from the Philadelphia area to educate them about the positive impact mechanical engineering has on society.

## TEACHING EXPERIENCE

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### Training Program

- DECEMBER 2017 | EGR 9220-Teaching in Higher Education Practicum  
SEPTEMBER 2017 | *Villanova University*  
Practically taught undergraduate classes under the supervision of an experienced instructor (Dr. Calvin Li); learned lessons from the instructor in collegiate level teaching; earned a “Certificate of Teaching Engineering in Higher Education Practicum”.
- MAY 2017 | EGR 9200-Teaching Engineering in Higher Education  
JANUARY 2017 | *Villanova University*  
Participated in a teaching program (only Ph.D. students allowed) which introduces contemporary theories of education at the collegiate level, and demonstrates many effective methods of engineering instruction. The course helps me to develop teaching skills that will promote active learning in the college classroom.

### Co-Instructor

- DECEMBER 2017 | EGR 5130-Introduction to Sustainable Energy  
SEPTEMBER 2017 | *Villanova University*  
Independently prepared and gave full lectures for the “Electrical Vehicles” section.

### Teaching Assistant

- DECEMBER 2016 | ME-3600 Fluid Mechanics  
SEPTEMBER 2014 | *Villanova University*  
Designed and graded homework and exams, held office hours, administered exams.