Wensi Wu (she/her/hers)
Email: wensiwu@seas.upenn.edu

Education

Cornell University Ithaca, New York
Ph.D., Structural Mechanics | **Minor: Computational Science and Engineering** May, 2021
- Dissertation: "Theoretical Formulation for Oblique Free Surface Impact Emanating from Fluid-Structure Interaction Simulations"
- Committee: Christopher J. Earls (chair), Peter Diamessis, Derek Warner

M.S., Structural Engineering August, 2018
B.S., Civil Engineering | *Magna Cum Laude* May, 2015

Academic Positions

University of Pennsylvania | *Research Assistant Professor* 2025–Present
Children's Hospital of Philadelphia | *Research Assistant Professor* 2025–Present
Children's Hospital of Philadelphia | *Research Associate Scientist* 2023–2025
Children's Hospital of Philadelphia | *Postdoctoral Fellow* 2021–2023

Honors and Awards

Additional Ventures SVRF: Independent Investigator Research Award 2025–2028
NIH/NHLBI K25 Mentored Quantitative Research Career Development Award 2023–2027
NIH/NHLBI NRSA T32 Institutional Research Training Fellowship 2022–2023
U.S. National Congress on Computational Mechanics Conference Travel Award 2023
Cornell University Conference Travel Grant 2017–2019
Cornell University Ve-Sing and Tseng So Koo Award 2015
NSF Research Experiences for Undergraduates Best Overall Project (Ranked 1st of 8 groups) 2013
Tau Beta Pi National Engineering Honor Society 2013–Present
Chi Epsilon National Civil Engineering Honor Society 2013–Present

Refereed Journal Publications

8. **W. Wu**, M. Daneker, C. Herz, H. Dewey, J.A. Weiss, A.M. Pouch, L. Lu, M.A. Jolley. "A Noninvasive Method for Determining Elastic Parameters of Valve Tissue Using Physics-Informed Neural Networks," *Acta Biomaterialia*, Vol. 200, 283-298, 2025.

7. **W. Wu**, M. Daneker, K.T. Turner, M.A. Jolley, L. Lu. "Identifying Heterogeneous Micromechanical Properties of Biological Tissues via Physics-Informed Neural Networks," *Small Methods*, Vol. 9, 2400620, 2025.

6. **W. Wu**, M. Daneker, M.A. Jolley, K.T. Turner, L. Lu. "Effective Data Sampling Strategies and Boundary Condition Constraints of Physics-Informed Neural Networks for Identifying Material Properties in Solid Mechanics," *Applied Mathematics and Mechanics*, Vol. 44, 1039-1068, 2023.

5. **W. Wu**, S. Ching, P.M. Sabin, D.W. Laurence, S.A. Maas, A. Lasso, J.A. Weiss, M.A. Jolley. "The Effects of Leaflet Material Properties on the Simulated Function of Regurgitant Mitral Valves," *Journal of the Mechanical Behavior of Biomedical Materials*, Vol. 142, 105858, 2023.

4. **W. Wu**, S. Ching, S.A. Maas, A. Lasso, P.M. Sabin, J.A. Weiss, M.A. Jolley. "A Computational Framework for Atrioventricular Valve Modeling using Open-Source Software," *Journal of Biomechanical Engineering*, Vol. 144, 101012, 2022.

3. **W. Wu**, C.J. Earls. "A New Engineering Theory Describing Oblique Free Surface Impact by Flexible Plates," *Ocean Engineering*, Vol. 256, 111473, 2022.

2. **W. Wu**, C. Bonneville, C.J. Earls. "A Principled Approach to Design using High Fidelity Fluid-Structure Interaction Simulations," *Finite Element in Analysis & Design*, Vol. 194, 103562, 2021.

1. **W. Wu**, J.W. Kosianka, H.M. Reed, C.J. Stull, and C.J. Earls. "CU-BENs: A Structural Finite Element Library," *SoftwareX*, Vol. 11, 100485, 2020.

Preprint and Ongoing Work

1. N.R. Mangine, D.W. Laurence, P.M. Sabin, **W. Wu**, C. Herz, C.N. Zelonis, J.S. Unger, C. Pinter, A. Lasso, S.A. Maas, J.A. Weiss, M.A. Jolley. "Effect of Parametric Variation of Chordae Tendineae Structure on Simulated Atrioventricular Valve Closure," *arxiv.org/pdf/2411.09599v1*.

Refereed Conference Proceedings

2. **W. Wu**, Y. Wu, A.M. Sulentic, J.C. Gee, A.M. Pouch, M.A. Jolley. "Physics in the Loop: Integrating Biomechanics-Derived Training Data into a Neural Ordinary Differential Equation-Based Deformable Registration Framework," *Medical Imaging with Deep Learning*, 2024.

1. P.J. Hughes, W. Scott, **W. Wu**, R.J. Kuether, M.S. Allen, and P. Tiso. "Interface Reduction on Hurty/Craig-Bampton Substructures with Frictionless Contact," *Nonlinear Dynamics*, Vol. 1, Conference Proceedings of the Society for Experimental Mechanics Series, 2019.

Research Grants

Title: Understanding Biomechanical Mechanisms of Atrioventricular Valve Failure in Single Ventricle Patients

- **Funding Mechanism:** Additional Ventures Single Ventricle Research Fund
- **Status of Support:** Active
- **Period of Support:** July 1, 2025 to June 30, 2028
- **Level of Support:** $659,937
- **Role:** Principal Investigator

Title: Development of Machine Learning Models for Cardiovascular Simulations

- **Funding Mechanism:** National Science Foundation, ACCESS
- **Status of Support:** Active
- **Period of Support:** June 20, 2025 to June 19, 2026
- **Level of Support:** $42,636 worth of GPU hours
- **Role:** Principal Investigator

Title: Toward Patient-Specific Computational Modeling of Tricuspid Valve Repair in Hypoplastic Left Heart Syndrome

- **Funding Mechanism:** NIH National Heart Lung Blood Institute K25 Mentored Quantitative Research Career Development Award
- **Status of Support:** Active
- **Period of Support:** September 1, 2023 to August 31, 2027
- **Level of Support:** $653,827
- **Role:** Principal Investigator

Title: A Novel, Non-invasive Computational Approach for Determining the Etiology of Tricuspid Regurgitation in Patients With Hypoplastic Left Heart Syndrome

- **Funding Mechanism:** Ruth L. Kirschstein National Research Service Award T32 Institutional Research Training Fellowship
- **Status of Support:** Past
- **Period of Support:** July 1, 2022 to August 31, 2023
- **Level of Support:** $76,140 to Wu
- **Role:** Principal Investigator (**PD:** Robert J. Levy)

Title: Deep Learning and Physics-Informed Neural Networks to Advance Single Ventricle Atrioventricular Valve Modeling

- **Funding Mechanism:** Additional Ventures Expansion Award
- **Status of Support:** Past
- **Period of Support:** July 1, 2022 to June 30, 2023
- **Level of Support:** $50, 000 for research equipment
- **Role:** Co-Investigator (**PIs:** Matthew A. Jolley, Alison M. Pouch, and Lu Lu)

Title: Partitioned Approach, Implicit Fluid-Structure Interaction for the Study of Hydroelastic Effects in High Speed Watercraft

- **Funding Mechanism:** National Science Foundation, XSEDE
- **Status of Support:** Past
- **Period of Support:** April 20, 2020 to April 19, 2021
- **Level of Support:** $1,157 worth of CPU hours
- **Role:** Primary Investigator (**PI:** Christopher J. Earls)

Conference Presentations

15. **W. Wu**, M. Daneker, K.T. Turner, M.A. Jolley, L. Lu. "Determining Heterogeneous Elastic Properties of Soft Materials using Physics-Informed Neural Networks," *2024 Materials Science & Technology,* Pittsburgh, Pennsylvania, US. October 2024. [Oral].

14. **W. Wu**, M. Daneker, K.T. Turner, M.A. Jolley, L. Lu. "Determining Heterogeneous Elastic Properties of Soft Materials using Physics-Informed Neural Networks," 4^{th} *International Workshops on Advances in Computational Mechanics,* Kitakyushu, Japan. September 2024. [Oral].

13. **W. Wu**, M. Daneker, K.T. Turner, M.A. Jolley, L. Lu. "An Accurate Physics-Informed Neural Network Architecture for Determining the Heterogeneous Micromechanical Elastic Properties of Biological Materials," 16^{th} *World Congress on Computational Mechanics,* Vancouver, British Columbia, Canada. July 2024. [Oral].

12. **W. Wu**, Y. Wu, A.M. Sulentic, J.C. Gee, A.M. Pouch, M.A. Jolley. "Physics in the Loop: Integrating Biomechanics-Derived Training Data into a Neural Ordinary Differential Equation-Based Deformable Registration Framework", *Medical Imaging with Deep Learning,* Paris, France. July 2024. [Poster].

11. N. Mangine, P.M. Sabin, D.W. Laurence, **W. Wu**, C. Herz, C.N. Zelonis, C. Pinter, A. Lasso, S. Ching, S.A. Maas, J.A. Weiss, M.A. Jolley. "A Parametric Analysis of Chordae Tendineae Density and Branching in Finite Element Simulations of Mitral Valve Closure," *2024 Summer Biomechanics, Bioengineering and Biotransport Conference,* Lake Geneva, Wisconsin, US. June 2024. [Oral].

10. C.N. Zelonis, N. Mangine, K. Sunderland, S.A. Maas, S. Ching, Y. Barak-Corren, D.W. Laurence, **W. Wu**, P.M. Sabin, A. Lasso, M. Gillespie, J.A. Weiss, M.A. Jolley. "Simulation of Self-Expanding Transcatheter Pulmonary Valve Deployment in the Right Ventricular Outflow Tract," *2024 Summer Biomechanics, Bioengineering and Biotransport Conference,* Lake Geneva, Wisconsin, US. June 2024. [Poster].

9. P.M. Sabin, D.W. Laurence, **W. Wu**, C. Herz, S.A. Maas, J.A. Weiss, M.A. Jolley. "Evaluation of Transcatheter Edge-to-Edge Repair Clip Selection via an Open-Source Finite Element Simulation Framework," *2024 Summer Biomechanics, Bioengineering and Biotransport Conference,* Lake Geneva, Wisconsin, US. June 2024. [Poster].

8. **W. Wu**, M. Daneker, M.A. Jolley, K.T. Turner, L. Lu. "Effective Physics-Informed Machine Learning Strategies for Material Identification," 17^{th} *U.S. National Congress on Computational Mechanics,* Albuquerque, New Mexico, US. July 2023. [Oral].

7. **W. Wu** and L. Lu. "Machine Learning for Material Designs," *MACH 2023,* Baltimore, Maryland, US. June 2023. [Oral].

6. **W. Wu** and C.J. Earls. "Towards a Generalized Engineering Theory for Hydrodynamic Slamming Emanating from Partitioned Fluid-Structure Interaction Analysis," 16^{th} *U.S. National Congress on Computational Mechanics,* Virtual. July 2021. [Oral].

5. **W. Wu** and C.J. Earls. "Tightly Coupled, Partitioned Fluid-Structure Interaction Analysis of a Horizontal Plate Impact onto a Water Free Surface: Computational Framework and Validation," 15^{th} *U.S. National Congress on Computational Mechanics,* Austin, Texas, US. July 2019. [Oral].

4. **W. Wu** and C.J. Earls. "Open Source, Tightly Coupled, Partitioned Fluid-Structure Interaction Modeling Framework for Naval Applications: The Impact of Slamming Loads on High Speed Watercraft," 13^{th} *World Congress on Computational Mechanics,* New York City, New York, US. July 2018. [Oral].

3. P.J. Hughes, W. Scott, **W. Wu**, R.J. Kuether, M.S. Allen, and P. Tiso. "Interface Reduction on Hurty / Craig-Bampton Substructures with Frictionless Contact," *IMAC Annual Meeting*, Orlando, Florida, US. February 2018. [Oral].

2. **W. Wu**, J.W. Kosianka, and C.J. Earls. "Open Source, Tightly Coupled, Partitioned Fluid-Structure Interaction Simulation Capability for High Spatiotemporal Resolution During Study of Wave Impact Loads in High Speed Watercraft," 14^{th} *U.S. National Congress on Computational Mechanics,* Montreal, Canada. July 2017. [Oral].

1. J.W. Kosianka, **W. Wu**, and C.J. Earls. "Condition Assessment and Prognosis using Fluid-Structure Interaction within a Reduced-Order Model Tracking Inversion Framework," 14^{th} *U.S. National Congress on Computational Mechanics,* Montreal, Canada. July 2017. [Oral].

Workshop Presentation

1. **W. Wu**. "Determining Heterogeneous Elastic Properties of Biological Tissues using Physics-Informed Neural Networks," *the NSF AI Institute for Artificial Intelligence and Fundamental Interactions Summer Workshop at MIT,* Boston, Massachusetts. August 2024.

Leadership Experience

Children's Hospital of Philadelphia / University of Pennsylvania

Biomedical Postdoctoral Council at the University of Pennsylvania | *Career and Training Committee* 2022–2023

Cornell University

CEE Graduate Student Association | *Vice President* 2020–2021
Engineering Learning Initiatives program | *TA Development Consultant* 2018–2019
CEE Graduate Student Association | *Treasurer* 2016–2017
Chi Epsilon National Civil Engineering Honor Society | *Treasurer* 2014–2015
American Society of Civil Engineers | 2013–2014
2014 ASCE Upstate NY Region Student Conference Committee

Teaching Experience

Children's Hospital of Philadelphia / University of Pennsylvania
Multi-institutional Placenta Biomechanics Workshop | *Facilitator* Spring 2024
- Participating institutions included Perelman School of Medicine at the University of Pennsylvania and Vanderbilt University

Cornell University
CEE 4740: Introduction to The Behavior of Metal Structures | *Teaching Assistant* Spring 2019
CEE 3720: Intermediate Solid Mechanics | *Guest Lecturer* Summer 2018
CEE 4780/6780: Structural Dynamics and Earthquake Engineering | *Teaching Assistant* Spring 2018

Professional Memberships

U. S. Association for Computational Mechanics
American Society of Civil Engineers

Professional Services

Application/Abstract Reviewer
• Intersections Science Fellows Symposium • Science Slam Competition at the Children's Hospital of Philadelphia • Biomedical Postdoctoral Research Symposium at University of Pennsylvania

Manuscript Reviewer
• Journal of the Royal Society Interface • Medical Engineering and Physics • Journal of the Mechanical Behavior of Biomedical Materials • APL Machine Learning