
RESERACH OVERVIEW

My research focuses on pioneering emerging computational methods to efficiently simulate complex mechanical and biological systems, with the goal of providing trustworthy predictive models to inform surgical decision-making.

EDUCATION

Cornell University	Ithaca, New York
Ph.D., Structural Mechanics Minor: Computational Science and Engineering	May 24 th , 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 20 th , 2018
B.S., Civil Engineering <i>Magna Cum Laude</i>	May 30 th , 2015

ACADEMIC APPOINTMENTS

University of Pennsylvania <i>Research Assistant Professor</i>	2025–Present
Children’s Hospital of Philadelphia <i>Research Assistant Professor</i>	2025–Present
Children’s Hospital of Philadelphia <i>Research Associate Scientist</i>	2023–2025
Children’s Hospital of Philadelphia <i>Postdoctoral Fellow</i>	2021–2023
Cornell University <i>Graduate Research Assistant</i>	2015–2021
Cornell University <i>TA Development Consultant</i>	2018–2019
Sandia National Laboratories <i>Visiting Researcher</i>	Summer 2017
Duke University <i>NSF REU Fellow</i>	Summer 2014
University of Cincinnati <i>NSF REU Fellow</i>	Summer 2013

HONORS AND AWARDS

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 Sponsored Research Experiences for Undergraduates Best Overall Project	2013
Tau Beta Pi National Engineering Honor Society	2013–Present
Chi Epsilon National Civil Engineering Honor Society	2013–Present

PREPRINT AND ONGOING WORK

1. **W. Wu**, M. Daneker, C. Herz, H. Dewey, J.A. Weiss, A.M. Pouch, L. Lu, M.A. Jolley. “ADEPT: A Noninvasive Method for Determining Elastic Properties of Valve Tissue,” *arxiv.org/pdf/2409.19081v1*. *Under review*.

REFEREED JOURNAL PUBLICATIONS

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*, 2400620, 2024.
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, 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.

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.

INVITED CONFERENCE TALKS

2. "Determining Heterogeneous Elastic Properties of Soft Materials using Physics-Informed Neural Networks," *2024 Materials Science & Technology*, Pittsburgh, Pennsylvania, US. October 2024.
1. "Determining Heterogeneous Elastic Properties of Soft Materials using Physics-Informed Neural Networks", *4th International Workshops on Advances in Computational Mechanics*, Kitakyushu, Japan. September 2024.

CONFERENCE PRESENTATIONS

13. **W. Wu (Presenter)**, 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," *16th World Congress on Computational Mechanics*, Vancouver, British Columbia, Canada. July 2024. [Oral].
12. **W. Wu (Presenter)**, 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 (Presenter)**, M. Daneker, M.A. Jolley, K.T. Turner, L. Lu. "Effective Physics-Informed Machine Learning Strategies for Material Identification," 17th U.S. National Congress on Computational Mechanics, Albuquerque, New Mexico, US. July 2023. [Oral].
7. **W. Wu (Presenter)** and L. Lu. "Machine Learning for Material Designs," MACH 2023, Baltimore, Maryland, US. June 2023. [Oral].
6. **W. Wu (Presenter)** and C.J. Earls. "Towards a Generalized Engineering Theory for Hydrodynamic Slamming Emanating from Partitioned Fluid-Structure Interaction Analysis," 16th U.S. National Congress on Computational Mechanics, Virtual. July 2021. [Oral].
5. **W. Wu (Presenter)** 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," 15th U.S. National Congress on Computational Mechanics, Austin, Texas, US. July 2019. [Oral].
4. **W. Wu (Presenter)** 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," 13th 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 (Presenter)**, 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," 14th 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," 14th U.S. National Congress on Computational Mechanics, Montreal, Canada. July 2017. [Oral].

SEMINAR TALKS AND WORKSHOP

3. "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.

2. "Discovering Material Properties of Soft Tissue Through Machine Learning," Children's Hospital of Philadelphia Cardiology Research Training Seminar, Philadelphia, Pennsylvania. May 2023.
1. "Toward Patient-Specific Computational Modeling of Tricuspid Valve Repair in Hypoplastic Left Heart Syndrome," Children's Hospital of Philadelphia Cardiology Research Training Seminar. Philadelphia, Pennsylvania. May 2022.

RESEARCH GRANTS

Systemic Semilunar Valve (SSV) Mechanics and Simulated Repair in Congenital Heart Disease

- **Funding Mechanism:** Children's Hospital of Philadelphia Cardiac Center Innovational Award
- **Period of Support:** July 1, 2024 to June 31, 2026
- **Level of Support:** \$200,000
- **Principal Investigators:** Matthew A. Jolley and Alison M. Pouch
- **Role:** Co-Investigator

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
- **Period of Support:** September 1, 2023 to August 31, 2027
- **Level of Support:** \$653,827
- **Role:** Principal Investigator

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
- **Period of Support:** July 1, 2022 to August 31, 2023
- **Level of Support:** \$76,140 to Wu
- **Program Director:** Robert J. Levy
- **Role:** Principal Investigator

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

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

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

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

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

Sport Taekwondo Student Club | *Treasurer and Practice Leader* 2019–2021

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

International High School at Prospect Heights

International Dreamers Scholarship Fund | *Selection Committee* 2018–2022

TEACHING EXPERIENCE

Children's Hospital of Philadelphia / University of Pennsylvania

Multi-institutional Placenta Biomechanics One-day 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

MENTORING EXPERIENCE

Children's Hospital of Philadelphia / University of Pennsylvania

Madeline Fialkov | *Currently an undergraduate student at Grinnell College* Summer 2024

Nicolas Mangine | *Currently a research technician at Children's Hospital of Philadelphia* 2023–Present

Christopher N. Zelonis | *Currently a research specialist at Children's Hospital of Philadelphia* 2023–Present

Silvani Amin | *Currently a PhD student at University of Pennsylvania* 2021–Present

Mitchell Danaker | *Currently a PhD student at University of Pennsylvania* 2021–Present

Stephen Ching | *Currently a PhD student at University of Pennsylvania* 2021–2023

Cornell University

Dana Luong | *Currently pursuing a PhD at Albert Einstein College of Medicine* 2016–2020

PROFESSIONAL SERVICES

Application/Abstract Reviewer

Intersections Science Fellows Symposium 2023

Science Slam Competition at the Children's Hospital of Philadelphia 2023

Biomedical Postdoctoral Research Symposium at University of Pennsylvania 2022

Manuscript Reviewer

Journal of the Royal Society Interface; Medical Engineering and Physics; Journal of the Mechanical Behavior of Biomedical Materials; APL Machine Learning.

PROFESSIONAL MEMBERSHIPS

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