Wensi Wu (she/her/hers)
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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 2021

- Dissertation: "Theoretical Formulation for Oblique Free Surface Impact Emanating from Fluid-Structure Interaction Simulations"
- Committee: Christopher Earls (chair), Peter Diamessis, Derek Warner

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

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

Academic Experience

Children's Hospital of Philadelphia | *Research Associate Scientist* 2023–Now
Scientific mentors: Drs. Matthew A. Jolley, Alison M. Pouch, Lu Lu, and Jeffrey Weiss
Advisory mentors: Drs. Brian Litt, Kevin T. Turner, and Susan Furth

- Developing a physics-informed machine learning framework for learning atrioventricular heart valve mechanical properties from medical images.

Children's Hospital of Philadelphia | *Postdoctoral Fellow* 2021–2023
Mentors: Drs. Matthew A. Jolley, Alison M. Pouch, Lu Lu, Jeffrey Weiss, and Kevin T. Turner

- Activtively engaged in the development open-source computational framework for atrioventricular valve modeling.
- Studied the effects of leaflet mechanical properties and morphologies on the resulting function of pathological atrioventricular valves.

Cornell University | *Graduate Research Assistant* 2015–2021
Mentor: Dr. Christopher Earls

- Developed a simple and accurate engineering theory for hydrodynamic slamming using high fidelity fluid-structure interaction analyses.

Sandia National Laboratories | *Visiting Researcher* Summer 2017
Mentors: Drs. Robert Kuether, Matthew Allen, and Paolo Tiso

- Implemented regularized Coulomb friction subroutine to study the influence of friction in the contact interface of jointed structure.

Duke University | *NSF REU Fellow* Summer 2014
Mentor: Dr. Guglielmo Scovazzi

- Studied the resulting pressure distribution of a brain model subjected to blast loading through fluid-structure interaction simulations.

University of Cincinnati | *NSF REU Fellow* Summer 2013
Mentors: Drs. Margaret Kupferle and George Sorial

- Conducted experimental studies to evaluate the contaminant absorption performance between commercial activated carbon and in-house developed activated carbon.

Refereed Journal Publications

1. **W. Wu**, M. Daneker, K.T. Turner, M.A. Jolley, L. Lu*. "Identifying Heterogeneous Micromechanical Properties of Biological Tissues via Physics-Informed Neural Networks," *arxiv.org/abs/2402.10741. Under Review*.

2. **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.

3. **W. Wu**, S. Ching, P. 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. 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.

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

6. **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.

7. **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.

* Denotes corresponding author

Refereed Conference Proceeding

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.

Conference Presentations

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

2. **W. Wu*** and L. Lu (2023) "Machine Learning for Material Designs," *MACH 2023,* Baltimore, Maryland.

3. **W. Wu*** and C.J. Earls (2021) "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.

4. **W. Wu*** and C.J. Earls (2019) "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.

5. **W. Wu*** and C.J. Earls (2018) "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.

6. P.J. Hughes*, W. Scott, **W. Wu**, R.J. Kuether, M.S. Allen, and P. Tiso (2018) "Interface Reduction on Hurty/Craig-Bampton Substructures with Frictionless Contact," *IMAC Annual Meeting*, Orlando, Florida.

7. **W. Wu***, J.W. Kosianka, and C.J. Earls (2017) "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.

8. J.W. Kosianka*, **W. Wu**, and C.J. Earls (2017) "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.

* Denotes presenter

Seminar Talks

1. **W. Wu** (2023) "Discovering the Material Properties of Soft Tissue Through Machine Learning," Children's Hospital of Philadelphia Cardiology Research Training Seminar.

2. **W. Wu** (2022) "Toward Patient-Specific Computational Modeling of Tricuspid Valve Repair in Hypoplastic Left Heart Syndrome," Children's Hospital of Philadelphia Cardiology Research Training Seminar.

Grants

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

Funding Mechanism:	NIH/NHLBI 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

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

Funding Mechanism:	NRSA T32 Training Grant at the Children's Hospital of Philadelphia, Division of Pediatric Cardiology
Period of Support:	July 1, 2022 to August 31, 2023
Level of Support:	$64,777 to Wu
Program Director:	Robert J. Levy
Role:	Principal Investigator

Title: *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
Principal Investigator:	Matthew Jolley
Role:	Co-Investigator

Title: *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: CPUs worth $1,157
Principal Investigator: Christopher Earls
Role: Primary Investigator

Teaching Experience

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

Leadership Experience

Perelman School of Medicine, University of Pennsylvania
Biomedical Postdoctoral Council | *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 TA Development 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

Professional Service

2023 Intersections Science Fellows Symposium | *Application Reviewer* 2023
2023 Science Slam Competition at the Children's Hospital of Philadelphia | *Abstract Reviewer* 2023
Biomedical Postdoctoral Research Symposium at University of Pennsylvania | *Abstract Reviewer* 2022

Professional Memberships

U. S. Association for Computational Mechanics
Tau Beta Pi National Engineering Honor Society
Chi Epsilon National Civil Engineering Honor Society
American Society of Civil Engineers