

# Wensi Wu

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## RESEARCH INTERESTS

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- Finite volume method, finite element method, volume-of-fluid method
- Multiphysics multiphase problem, fluid-structure interaction
- Scientific computing, numerical methods for partial differential equations, machine learning

## EDUCATION

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**Cornell University**, Ithaca, New York expected 2021  
Ph.D. Candidate, Structural Mechanics  
Advisor: Christopher Earls

**Cornell University**, Ithaca, New York 2018  
M.S., Structural Mechanics

**Cornell University**, Ithaca, New York 2015  
B.S., Civil Engineering | *Magna Cum Laude*

## RESEARCH EXPERIENCE

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**Cornell University** | *Graduate Research Assistant* 2015–Present  
PI: Dr. Christopher Earls

- Implemented geometric and material nonlinearity methods along with numerical dissipation strategies, into the implicit Newmark time integration solver within an open source computational structural dynamics code (CU-BENs) to support partitioned fluid-structure interaction (FSI) simulations
- Built checkpoint and restart functions within CU-BENs to enhance solution robustness in cases of hardware failure or power outages
- Programmed prescribed structure body motion subroutine within CU-BENs to enable gross spatial translations and rotations of structural members
- Modified the interface coupling library within the FSI coupled CU-BENs and OpenFOAM software to couple the interface between the fluid and structure domains of the FSI models that are subjected to prescribed structure body motion

- Currently validating the FSI coupled CU-BENs and OpenFOAM software in an effort to develop a generalized engineering theory of wave slamming in watercraft

**Sandia National Laboratories** | *Visiting Researcher*

Summer 2017

Mentors: Dr. Robert Kuether, Dr. Matthew Allen, and Dr. Paolo Tiso

- Studied the dynamic response of a C-Beam model subjected to an impulse force using explicit Newmark time integration scheme
- Compared frequency response and computational time among the full and the reduced-order C-Beam models
- Implemented regularized Coulomb friction subroutine to incorporate friction calculations in contact interface of jointed structure

**Cornell University** | *Undergrad Research Assistant*

Spring 2015–Summer 2015

Mentor: Dr. Christopher Earls

- Studied the finite volume solids solvers, mesh motion formulations, and numerical implementations within an open source computational fluid dynamics library (OpenFOAM)
- Identified ways to port CU-BEN to OpenFOAM within a partitioned, invasive context wherein CU-BEN becomes a new class within OpenFOAM C++ API library structure

**Duke University** | *REU Fellow*

Summer 2014

Mentor: Dr. Guglielmo Scovazzi

- Compared the stabilities and the rate of convergence of a linear viscoelastic model, the Cook's membrane, using variational multi-scale stabilization (VMS) approach and compared against those without using VMS approach
- Modeled the pressure distribution around the brain subjected to explosion through FSI simulations of a blast interacting with a simplified brain model. The simplified brain model consisted of an outer elastic shell and an inner viscoelastic gel which represent the skull and the brain respectively

**University of Cincinnati** | *NSF REU Fellow*

Summer 2013

Mentors: Dr. Margaret Kupferle, Dr. George Sorial

- Conducted experiments and performed a comparative studies between commercial activated carbon and in-house developed activated carbon
- Confirmed micropore range oligomerization control was maintained in the presence of natural organic matter
- Identified higher mesopore percentage activated carbons have a greater adsorption capacity under oxic conditions due to oligomerization

## JOURNAL PUBLICATIONS

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1. **W. Wu**<sup>\*</sup>, C. Bonneville<sup>\*</sup>, C.J. Earls (2020), "A Principled Approach to Design Using High Fidelity Fluid-Structure Interaction Simulations", *Finite Element in Analysis & Design*, Elsevier (*under review*)
2. **W. Wu**, J.W. Kosianka, H. M. Reed, C.J. Stull, and C.J. Earls (2020) "CU-BENs: A structural finite element library", *SoftwareX*, Vol. 11, Elsevier, pp. 1-5.

<sup>\*</sup> Denotes equal contribution

## CONFERENCE PROCEEDINGS

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1. P.J. Hughes, W. Scott, **W. Wu**, R.J. Kuether, M.S. Allen, and P. Tiso (2019) "Interface Reduction on Hurty/Craig-Bampton Substructures with Frictionless Contact", In: Kerschen G. (eds) *Nonlinear Dynamics, Volume 1. Conference Proceedings of the Society for Experimental Mechanics Series*. Springer, Cham

## CONFERENCE PRESENTATIONS

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1. **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<sup>th</sup> *U.S. National Congress on Computational Mechanics*, Austin, Texas.
2. **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<sup>th</sup> *World Congress on Computational Mechanics*, New York City, New York.
3. 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.
4. **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<sup>th</sup> *U.S. National Congress on Computational Mechanics*, Montreal, Canada.
5. 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<sup>th</sup> *U.S. National Congress on Computational Mechanics*, Montreal, Canada.

## OTHER PRESENTATIONS/WORKSHOPS

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1. J.W. Kosianka, **W. Wu**, and C.J. Earls, (2017) "Introduction to CU-BEN: Theoretical Overview and Tutorials," *Cornell University CU-BEN Workshop*, Cornell University, Ithaca, New York.
2. **W. Wu**, (2013) "Influence of Activated Carbon Pore Size Distribution on the Removal of Water Contaminants," *Diversity in Scholarship and Engagement Symposium*, Cornell University, Ithaca, New York.

## TEACHING EXPERIENCE

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<b>Cornell University</b>   <i>Teaching Assistant</i> <i>CEE 4740: Introduction to The Behavior of Metal Structures</i>	Spring 2019
<b>Cornell University</b>   <i>Teaching Assistant</i> <i>CEE 4780/6780: Structural Dynamics and Earthquake Engineering</i>	Spring 2018
<b>Syracuse University</b>   <i>Academic Excellence Workshops Facilitator</i> <i>MATH 295: Calculus I</i> <i>MATH 296: Calculus II</i>	2012–2013

## HONORS AND AWARDS

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<b>Ve-Sing and Tseng So Koo Award:</b> awarded to an outstanding student of structural engineering in Civil and Environmental Engineering who is planning to pursue graduate studies at Cornell University.	2015
<b>NSF Sponsored Research Experiences for Undergraduates Best Overall Project:</b> awarded to the student project team with the highest score on project poster, technical report, and final presentation.	2013

## PROFESSIONAL MEMBERSHIPS

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Tau Beta Pi National Engineering Honor Society  
Chi Epsilon National Civil Engineering Honor Society  
American Society of Civil Engineers (ASCE)

## LEADERSHIP EXPERIENCE

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<b>Cornell University CEE Graduate Student Association</b> <i>Vice President</i>	2020–2021
<b>Cornell University Sport Taekwondo Student Club</b> <i>Treasurer</i>	2019–2021

<b>Cornell University Engineering Teaching Assistant Development Program</b> <i>TA Development Consultant</i>	2018–2019
<b>Cornell University CEE Graduate Student Association</b> <i>Treasurer</i>	2016–2017
<b>Chi Epsilon National Civil Engineering Honor Society</b> <i>Treasurer</i>	2014–2015
<b>American Society of Civil Engineers</b> <i>2014 ASCE Upstate NY Region Student Conference Committee</i>	2013–2014