Benjamin J. Thomas

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EDUCATION

The University of Texas at Austin Austin, TX
Ph.D. Student, Computational Science, Engineering, and Mathematics Expected May 2028
Oden Institute for Computational Engineering & Sciences GPA: 3.77/4.0
Computational Medicine Portfolio
Member of Willerson Center for Cardiovascular Modeling and Simulation (WCCMS)
Dissertation Committee: Michael Sacks (Advisor), Richard Tsai, Jesse Chan, Charley Taylor, Alfio Quarteroni

Louisiana State University Baton Rouge, LA
B.S. Computational Mathematics (Honors) May 2022
B.S. Biological & Agricultural Engineering
Roger Hadfield Ogden Honors College GPA: 4.12/4.3
Distinguished Communicator Distinction

RESEARCH EXPERIENCE

Graduate Research Assistant, Oden Institute Jan 2023 – Present

- Lead developer of the group's finite element code, **CARDIAX**, written in Google JAX.
- Architected the neural network finite element (**NNFE**) framework for high-speed mechanics.
- Developing a THB-spline library in JAX for superior geometric fidelity in cardiac modeling.

Summer Researcher, Simula Research Laboratory (SSCP) June 2024 – Aug 2024

- Attended intensive lectures on computational physiology for three weeks
- Created a Finite Element to Machine Learning (FE-ML) pipeline for cardiac solution maps.
- Successfully trained ML models to learn solution maps based on shape and material parameters.

Undergraduate Research Assistant, LSU Bio Engineering Dept. May 2022 – Aug 2022

- Collaborated with Chemical Engineering to develop PHA pellets for denitrification.
- Created ur5e robotic simulations in Python and designed a robotic arm for moving-base crawfish harvesting.

Undergraduate Research Assistant, LSU Mathematics Dept. Aug 2018 – May 2022

- Implemented neural networks and self-organizing maps in Python for curve classification.
- Developed and defended Honors Thesis: "DNA Curve Classification with Unsupervised Learning."
- Performed large-scale computations on university supercomputing clusters.

Undergraduate Research Intern, IPAM & AMD Research June 2021 – Aug 2021

- Developed Physics-Informed Neural Networks (PINNs) using TensorFlow for wave data.
- Performed data preprocessing and collaborated with a team to present findings to AMD Research.

Undergraduate Research Intern, IUPUI REU (Virtual) June 2020 – July 2020

- Converted a topology optimizer from MATLAB to Python.

- Modeled cell growth in Python and created a graphical user interface for tool accessibility.

TEACHING & MENTORSHIP

Mentor, Direct Reading Program (DiRP) Jan 2025 – Present

- Teach undergraduates specialized topics in machine learning and computational medicine.
- Host weekly lecturing sessions and create tailored assignments to develop CS skills.

Supplemental Instructor (Dynamics), LSU College of Engineering Aug 2020 – May 2022

- Facilitated exam reviews and created worksheets for over 200 students in Engineering Dynamics.
- Managed communication between the professor and student body to improve learning outcomes.

Tutor, LSU Mathematics Department Jan 2018 – May 2020

- Tutored students in Calculus I–III, Differential Equations, and Linear Algebra.
- Organized schedules for 10 tutors and used Mathematica for concept visualization.

PUBLICATIONS

Journal Publications (Accepted & In Press)

- **Benjamin J. Thomas**, Christian Goodbrake, Kenneth Meyer, Michael S. Sacks. "High Speed Cardiac Simulations Using the JAX Framework." *Functional Imaging and Modeling of the Heart*. Accepted, April 2025.
- Michael S. Sacks, **Benjamin J. Thomas**, Christian Goodbrake, Aldan Webb, Charles V. Kingsley, Jason Stafford, Gregory P. Reece, Kristy Brock. "A Novel Diffusion Tensor Based Three-Dimensional Constitutive Model for Human Breast Tissue." *Journal of the Mechanical Behavior of Biomedical Materials*. Accepted, April 2025.

Peer-Reviewed Conference Papers

- Davini, D., Samineni, B., **Thomas, B. J.**, Tran, A., Zhu, C., Ha, K., Dasika, G., White, L. "Using physics-informed regularization to improve extrapolation capabilities of neural networks." *NeurIPS: Machine Learning and the Physical Sciences*, December 2021.

Manuscripts In Preparation & Submitted

- **Benjamin J. Thomas**, Michael S. Sacks. "CARDIAX-NNFE: A Scientific Machine Learning Framework for Cardiac Mechanics." *SoftwareX*. In Preparation, April 2026.
- **Benjamin J. Thomas**, Christian Goodbrake, Kenneth Meyer, Michael S. Sacks. "CARDIAX: A JAX-based Platform for Rapid Cardiac Functional Simulations." *engrxiv*. Submitted/Preprint. DOI: 10.31224/4923.

PRESENTATIONS

- **Biomedical Engineering Society (BMES) Annual Meeting**, Oct 2025. "High Speed Cardiac Simulations Using the JAX Framework." (Talk)
- **Computer Methods in Biomechanics and Biomedical Engineering (CMBBE)**, Sept 2025. "High Speed Cardiac Simulations Using the JAX Framework." (Talk)

- **U.S. National Congress on Computational Mechanics (USNCCM)**, July 2025. "High Speed Cardiac Simulations Using the JAX Framework." (Talk)
- **European Society of Biomechanics (ESB) Congress**, July 2025. "A Novel Diffusion Tensor Based 3D Constitutive Model for Human Breast Tissue." (Talk)
- **Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C)**, June 2025. "A Novel Diffusion Tensor Based 3D Constitutive Model for Human Breast Tissue." (Talk)
- **Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C)**, June 2025. "High Speed Cardiac Simulations Using the JAX Framework." (Poster)
- **Functional Imaging and Modeling of the Heart (FIMH)**, June 2025. "High Speed Cardiac Simulations Using the JAX Framework." (Poster)
- **Biomedical Engineering Society (BMES) Annual Meeting**, Oct 2024. "A Novel Method for Analyzing In Vivo Wall Deformation in the Human Basilar Artery." (Presenter)
- **Biomedical Engineering Society (BMES) Annual Meeting**, Oct 2024. "A Novel Diffusion Tensor Myocardial Material Model Using Neural Networks." (Poster)
- **Summer School in Computational Physiology (SSCP)**, Aug 2024. "Deep Learning for Predicting End Systolic Shape." (Talk)
- **World Congress on Computational Mechanics (WCCM)**, July 2024. "A Novel Diffusion Tensor Myocardial Material Model Using Neural Networks For Form Determination." (Talk)
- **European Society of Biomechanics (ESB) Congress**, July 2024. "A Novel Neural Network Finite Element Approach for High-speed Cardiac Mechanics Simulations." (Presenter, Talk)
- **Summer Biomechanics, Bioengineering, and Biotransport Conference (SB3C)**, June 2024. "A Novel Diffusion Tensor Myocardial Material Model Using Neural Networks For Form Determination." (Talk)
- **Texas Advanced Computing Center (TACC) Symposium for Texas Education and Research (TACCSTER)**, Sept 2023. "Machine Learning for Myocardium Material Model Form Determination." (Poster)
- **Joint Mathematics Meetings (JMM)**, April 2022. "Using Physics-Informed Regularization to Improve Extrapolation Capabilities of Neural Networks." (Poster/Talk)
- **Institute for Pure and Applied Mathematics (IPAM)**, Aug 2021. "Using Physics-Informed Regularization to Improve Extrapolation Capabilities of Neural Networks." (Talk)
- **AMD Research Summer Showcase**, Aug 2021. "GPU-Accelerated High-Performance Computing for Scientific Applications." (Talk)
- **Texas-Louisiana Undergraduate Mathematics Conference (TLUMC)**, Oct 2020. "Self-Organizing Maps for Curve Classification." (Poster/Talk)
- **Indiana Undergraduate Math Research Conference (IUMRC)**, July 2020. "Simple Python Implementation of the Cellular Potts Model." (Talk)

SERVICE & LEADERSHIP

Ombudsperson, CSEM Graduate Committee Aug 2025 – Present

- Serve as a bridge of communication between the Graduate Committee and the student body.
- Host student/faculty meetings and assist in reviewing the degree program and curriculum.

Babuska Forum Organizer, Oden Institute Aug 2024 – May 2025

- Managed 20+ seminars for faculty and postdocs; led Q&A and advertising.

SIAM Vice President, Student Chapter Aug 2024 – May 2025

- Coordinated speakers and organized undergraduate teams for modeling competitions.

Senior Design Lead, LSU Biological Engineering Aug 2020 – May 2021

- Led the design and programming of a robotic harvester arm, exceeding reliability metrics.

LSU Honors in Cuba Spring 2019

- Participated in academic exchange and cultural study at the University of Havana.

ADDITIONAL TRAINING

- Cardiac Physiology & Pathophysiology, Dell Medical School, UT Austin (Audit)
- CUDA Parallel Programming (Mike Giles)
- TACC Visualization Workshop (TACC)

TECHNICAL SKILLS

Languages/Frameworks: Python (JAX), MATLAB, Mathematica, LaTeX, Linux, C++.
Software/Tools: Git, Inkscape, VS Code, Obsidian.

HONORS & AWARDS

UT Graduate Recognition Fellowship; CSEM Graduate Fellowship; Astronaut Scholar; LSU Distinguished Communicator; President's Honor Roll (x6); Dean's List; TOPS Recipient; Peg and Tom Madden Mathematics Research Scholarship; William H. and Barbara A. Brown Scholarship; S&B Engineers and Constructors Scholarship.