BOLUTITO BABATUNDE

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EDUCATION

Carnegie Mellon University — Pittsburgh, PA
Doctor of Philosophy in Mechanical Engineering — May 2024
Master of Science in Mechanical Engineering — December 2022
Advisors: Dr. Rebecca E Taylor, Dr. Jonathan Cagan
Subject Matter Knowledge: automated design, generative design, mathematical optimization

Texas Tech University — Lubbock, TX
Bachelor of Science in Mechanical Engineering — May 2019
Minor: Computer Science, Mathematics

SKILLS

Languages: Python, C++ (OpenGL), Jekyll, html, css, Git
Software: LabVIEW, Creo, SOLIDWORKS

PHD RESEARCH

Carnegie Mellon University — Pittsburgh, PA
Thesis: Investigating a flexible framework for automating DNA origami design — August 2019 - May 2024

- Investigating a formalized approach for automating multilayer solid and hollow DNA origami nanostructure designs using generative optimization strategies (i.e shape annealing).
    - Conducting a case study to improve design uniformity by analyzing the effects of DNA helix route direction on structural porosity, thereby expanding the design search space and capabilities.
    - Creating a graph neural network to predict a single simulation time-step of DNA origami nanostructure behavior, thereby enhancing the formalized approach to generate mechanically robust structures.
    - Developed custom algorithms to convert the generated designs into formats compatible with scadnano and oxDNA, widely used design and simulation tools in the research community.
    - Collaborating with a post-Masters student for design manufacturing and a PhD candidate on developing a graph neural network.

ADDITIONAL RESEARCH EXPERIENCE

Los Alamos National Laboratory (LANL) — Los Alamos, NM
Athena Scholar Graduate Intern — May 2019 - August 2019

- Constructed a functional prototype of a temperature controller connected to a chamber for heating specimens using Programmable Logic Controller (PLC) for remote system operation.
- Enhanced electrical skills by designing, wiring, and soldering the electrical system for the temperature controller.
- Designed temperature controller parts for machining with Creo (3D modeling software).
- Utilized Robotic Operating System (ROS) and MoveIt to program robotic arm for grabbing heating mantle.

Los Alamos National Laboratory (LANL) — Los Alamos, NM
Future Female Leaders in Engineering (FFLIE) Undergraduate Intern — May 2018 - August 2018

- Constructed a functional prototype of a temperature controller connected to a heating mantle for heating specimens using Proportional-Integral-Derivative (PID) tuning.
- Enhanced electrical skills by designing, wiring, and soldering the electrical system for the temperature controller.
- Acquired data of temperature response with LABVIEW (systems engineering software).
- Designed temperature controller parts for machining with Creo (3D modeling software).

Texas Tech University — Lubbock, TX
Undergraduate Student Researcher at Biomedical: Micro/Nano Device Lab — January 2018 - May 2019

- Investigated a flexible, sensitive, and wearable strain sensor for monitoring biomedical disorders.
- Designed and built a circuit system that passes raw data through a low pass filter to a microcontroller.
- Created a program for data acquisition customized for detecting resistive strain.
- Characterized the strain sensor by performing stretch/release and bending cycles.

TEACHING ASSISTANT EXPERIENCE

Carnegie Mellon University — Pittsburgh, PA
F24-101: Fundamentals of Mechanical Engineering — January 2022 - May 2022

- Collaborated with Professor Diana Haidar to design comprehensive assessments with corresponding rubric and solutions.
- Introduced students to the fundamentals of engineering design, solid mechanics, thermal-fluid systems, and mechatronics.

ACADEMIC PROJECTS

(LTI-11685) Introduction to Deep Learning, Carnegie Mellon University Pittsburgh, PA
Protein Language Modeling: Coding Life's Code December 2023

- Collaborated with a master's student on modifying SPOT-1D-LM for single-sequence analysis, focusing on classifying protein structural properties using SS8 labels.
- Modified SPOT-1D-LM by replacing Prottrans embeddings for ProteinBERT and integrating additional ResNet layers, to investigate protein structure-function relationship.

(MEG-24787) Machine Learning and AI for Engineers, Carnegie Mellon University Pittsburgh, PA
Classifying the scaffold routing of computed DNA origami designs using CNN December 2022

- Collaborated on Google Colab with a PhD candidate to develop a custom convolution neural network (CNN) for classifying gaps in walls of generated hollow DNA origami design images.
- Demonstrated expertise in applying machine learning techniques to synthetic biomechanical design.

PUBLICATIONS

- **Babatunde, Bolutito**; Cagan, Jonathan; Taylor, Rebecca E. (2023). "An Improved Shape Annealing Algorithm for the Generation of Coated DNA Origami Nanostructures." *ASME Journal of Mechanical Design*. *accepted (Special Issue of the ASME Journal of Mechanical Design featuring top papers from IDETC 2023)
- **Babatunde, Bolutito**; Arias, Sebastian D.; Cagan, Jonathan; Taylor, Rebecca E. (2021). "Generating DNA Origami Nanostructures through Shape Annealing." *Applied Sciences*. 11, no. 7: 2950. https://doi.org/10.3390/app11072950

CONFERENCES / PRESENTATIONS

- **Babatunde, Bolutito**; Cagan, Jonathan; Taylor, Rebecca E. (20-23 August 2023). "An Improved Shape Annealing Algorithm for the Generation of Coated DNA Origami Nanostructures." International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC/CIE 2023), Boston Park Plaza, Boston, MA, USA.
- **Babatunde, Bolutito**; Cagan, Jonathan; Taylor, Rebecca E. (8-12 August 2022). "A refined shape annealing algorithm for the optimal generation of DNA origami designs." DNA28: The 28th International Conference on DNA Computing and Molecular Programming (*Track C*), University of New Mexico, Albuquerque, NM, USA.
- **Babatunde, Bolutito**; Arias, Sebastian D.; Cagan, Jonathan; Taylor, Rebecca E. (12-15 April 2021). "A formal approach for automated generation of DNA origami designs." FNANO 2021: 18th Annual Conference Foundations of Nanoscience (*Computational Tools*), Virtual.
- **Babatunde, Bolutito** & Jungkyu Kim (2019). "A Flexible Motion Sensor for Monitoring Biomechanical Disorders." Spring 2019 Undergraduate Research Conference, Texas Tech University, Lubbock, TX, USA.
- **Babatunde, Bolutito** & Jungkyu Kim (17-20 October 2018). "A Flexible Motion Sensor for Monitoring Biomechanical Disorders." 2018 BMES Annual Meeting, Georgia World Congress Center, Atlanta, GA, USA.
- **Babatunde, Bolutito** (2018). "Temperature Controller of Heating Mantle" 2018 Los Alamos National Laboratory Student Symposium, Los Alamos National Laboratory, Los Alamos, NM, USA.

AWARDS AND HONORS

MEOS (Mechanical Engineering Outreach Stars) Award – Silver Level June 2022
Department of Defense (DoD) National Defense and Engineering Graduation Fellowship Program (NDSEG) March 2021
National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP), *Declined* March 2021
National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM) Fellowship May 2019

VOLUNTEER EXPERIENCE

Mechanical Engineering Graduate Student Organization (MEGSO) Social Chair July 2022 – May 2023
2023 National Biomechanics Day at Carnegie Mellon University, Pittsburgh, PA March 2023
2022 National Biomechanics Day at Carnegie Mellon University, Pittsburgh, PA March, April 2022
5th Summer Physics Camp for Young Women (LANL), Virtual June 2021
2021 National Biomechanics Day at Carnegie Mellon University, Pittsburgh, PA April 2021
Gelfand Outreach Workshop - Nanoengineering with DNA, Pittsburgh, PA November 2019
Carnegie Science Center Sci Tech Day - Nanoengineering with DNA, Pittsburgh, PA November 2019