Abed Musaffar

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Education

University of California, Santa Barbara — Santa Barbara, CA
Cumulative GPA: 4.0 — 2018 – Present
College of Engineering, Ph.D. Mechanical Engineering

University of California, Santa Barbara
Upper Division GPA: 4.0, Cumulative GPA: 3.74
College of Engineering, B.S. Mechanical Engineering

Core Technical Skills

Programming Languages: Python 3, R, MATLAB 2018-2021, Simulink 2021, Simscape 2021, Bash
Web Development: HTML, CSS
Technical Skills: Microsoft Office Suite (Word, Project, Excel, Powerpoint), SolidWorks, Siemens NX, ML, LaTeX, ImageJ, TeamCenter
Operating Systems: Windows, MacOS, Linux (Arch, Ubuntu)
Spoken Languages: English (Fluent/Native), Arabic (Fluent), Spanish (Beginner)

Professional Experience

Biological Control, Computing, and Learning Laboratory — Santa Barbara, CA
Researcher — 2022 – Present

- Worked with advisor Professor Enoch Yeung in the Biological Control, Computing, and Learning Laboratory at UCSB
- Researched the application gyrase-facilitated topological control of genomic DNA
- Independently developed and on-boarded a Nanopore Sequencing based protocol for high-resolution mapping of gyrase cleavage activity in bacterial genomes
- Gained experience running a variety of experimental protocols such as DNA cloning and plate reader toxicity assays
- Developed Python modules for post-processing of data from lab equipment such as plate readers
- Collaborated with senior graduate students on ML-based approaches to identify genes of interest in biological networks and assisted in the application of joint dimensionality reduction based approaches for multi-omics analysis of data

Venturi Astrolab — Hawthorne, CA
Engineer, Intern — 2021 – 2021

- Worked at aerospace startup Venturi Astrolab as a Mechanical Engineering & Business intern in Hawthorne, CA
- Designed and developed a payload adapter plate to easily facilitate interfacing of assorted payload modules to the Astrolab FLEX rover. To date, the adapter plate has been used on every under-slung payload module demoed by Astrolab and is featured both on their website and in their Payload Users Guide.
- Designed and developed a structural suspension member currently in use on the Astrolab FLEX rover.
- Designed, sourced components for, and manufactured a demonstration payload crate for Astrolab that is featured in media on their website and on their YouTube.
- Developed GD&T for drawings of every designed component prior to manufacturing
- Assisted in the assembly of rover wheel motor housings
- Gained exposure to high-level day to day business managements tasks such as building development and finance

NASA Ames Research Center — Moffett Field, CA
Machine Learning, Intern — 2020 – 2021

- Worked at NASA Ames Research Center in Moffett Field, CA as part of their Intelligent Systems Division
- Researched the development of a machine learning model for unmanned navigation of non-urban terrain
- Generated training datasets for use in training the objective machine learning models. The training datasets developed included labeled images for both bounding box classification, as well as semantic segmentation classification.
- Implemented and trained a machine learning model utilizing the YOLOv3 architecture in PyTorch to recognize terrain of interest using a bounding box classification method.

- Implemented and trained a machine learning model utilizing Google's DeepLab V3 architecture in TensorFlow to recognize terrain of interest using a semantic segmentation classification method.

Daly Group Santa Barbara, CA
Researcher 2020 – 2022

- Worked with advisor Professor Samantha Daly, Dr. Bhavana Swaminathan, and Caelin Muir in the Daly Group at UCSB
- Researched the characterization of damage mechanisms in Ceramic Matrix Composites, high temperature structures for aerospace and space applications.
- Developed a novel edge detection algorithm using Python for automated analysis and visualization of sub-micron sized cracks
- Assisted in the development of algorithms to enable data visualization

NASA Ames Research Center Moffett Field, CA
Soft Robotics, Summer Intern 2014 – 2019 (Summers)

- Worked at NASA Ames Research Center in Moffett Field, CA as part of their Intelligent Systems Division
- Assisted in the development of soft-robotic structures known as tensegrities which are composed of elements of pure compression and pure tension and feature low mass and extremely high robustness
- Developed methods of rapidly prototyping six-rod tensegrity structures for experimentation with various configurations
- Collaborated in developing novel configurations that advance the robust nature of a six-rod tensegrity robot while mitigating potential failure modes
- Helped to design a simulation tool in JavaScript that could be used to develop a locomotion pattern for a six-rod tensegrity robot structure
- Implemented a locomotion pattern that was discovered for a six-rod structure in simulation onto a physical structure using Pololu servos and a micro controller with a stack-based programming language
- Developed potential prototypes of tensegrity drones and assisted a UC Berkeley PhD student by manufacturing a potential model for a tensegrity spine
- Investigated the potential for scalability of a six-rod tensegrity structure for potential terrestrial and extra-terrestrial applications
- Publisehd a lead author publication on the scalability and design of six-rod tensegrity robotic structures

Outreach Experience

Zed Factor Community Outreach Santa Clara, CA
Project Leader 2021 – 2022

- Coordinated with local Middle Eastern North African (MENA) community leaders to develop project itinerary
- Collaborated with MENA community leaders to develop community announcement to advertise the outreach opportunity
- Brainstormed activities that would be both engaging and educational for bi-monthly meetings
- Managed project budget of approximately 1000 USD to be used for procurement of educational resources and group field trips
- Reached out to local MENA aerospace professionals to schedule guest speakers

Chemistry Tutor Santa Barbara, CA
Tutor 2019 – 2020

- Scheduled biweekly meetings to tutor a high school student in chemistry
- Developed practice problem sets to provide problem solving experience
- Provided guidance on problem solving approach and procedure
- Through tutoring the student was able to achieve an A in the class

Physics Tutor Santa Barbara, CA
Tutor 2019 – 2020

- Scheduled three meetings a week with an undergraduate biology student to mentor him in introductory physics
- Developed practice problem sets and tests to gauge understanding and identify areas of focus
- Assisted in problem solving procedure
- Improved student performance from failing to a B in the class

Arabic Tutor Santa Barbara, CA
Tutor 2018 – 2019

- Scheduled weekly meetings with an undergraduate biopsychology major who was interested in learning Arabic
- Developed teaching curriculum to guide Arabic learning process
- Assisted in teaching both conversational and formal spoken Arabic
- Helped to develop reading and writing skills

Educational Experience

Lunar Regolith Excavator Santa Barbara, CA
Senior Capstone Project Leader 2021 – 2022

- Won the Best Innovation in Mechanical Engineering award ($1500 prize) for a Senior Capstone Design in Mechanical Engineering
- Led a team at UCSB to develop ARES, the Advanced Regolith Excavation System. ARES is a next-generation excavation module for the Venturi Astrolab FLEX rover that will enable mass harvesting of the lunar regolith for in-Situ Resource Utilization (ISRU).
- Independently reached out to Venturi Astrolab and negotiated funding for the project
- Collaborated with Venturi Astrolab to develop the scope of the project and independently interviewed potential candidates for the team
- Set project milestones and worked with team members to assign roles that emphasize their strengths
- Developed a team meeting and work schedule to ensure timeliness of deliverables and continuous progress
- Managed all team budgeting, expenditures, and purchasing throughout the course of the project
- Independently performed analysis for and designed a transmission that would enable the system to overcome soil forces during excavation by stepping up motor torque
- Sourced excavator transmission components including: a roller chain, sprockets, a motor, shafts, couplers, and bearings
- Cooperated with team members to model the completed transmission into CAD
- Participated in manufacturing integral structural components such as the structural arms, arm covers, and components of the structural frame. Assisted in manufacturing the transmission.
- Developed a preliminary design for an electrical system and sourced the necessary components. Collaborated with faculty and team members to optimize and implement a final design of the electrical system.
- Participated as one of the primary technical writers and presenters for the team. Received high praise from capstone instructors for the quality of my presentations and speech.
- Recorded and edited a video showcasing our team's design. The completed video was nominated as the second best during the final design exposition.

Ocean Drifter Santa Barbara, CA
Junior Capstone Research Engineer 2020 – 2021

- Designed concept for low-mass drifter capable of autonomous drone deployment for the purpose of ocean monitoring
- Invented water-soluble trigger for automated deployment of drifter
- Experimentally determined effect of submersion time on mechanical properties of materials
- Optimized for solubility rate and mechanical properties to select material and dimensions to ensure self-deployment of drifter at optimal water depth

Rocket Propulsion Laboratory Santa Barbara, CA
Chief Technology Officer 2019-2020

- Worked in the Rocket Propulsion Laboratory, a senior capstone project at UCSB endeavoring to develop a cryogenic liquid bipropellant rocket that will compete in the FAR Mars competition
- Assisted in the development of a cryogenic feed system to facilitate transportation of liquid cryogen from a containment dewar to the engine for ignition
- Performed analysis of system to determine risk of malfunction due to phenomena such as water hammer and developed strategies for mitigation
- Oversaw the development of critical Safety Operating Procedures (SOP) for testing, such as a chill down procedure to cool the system prior to fire

Awards

Most Innovative Design in Mechanical Engineering (2022)
Deans Honors (2020 – 2021)
College of Engineering Honors (2020 – 2021)
Zed Factor Fellow (Forbes Science Awards 2020: Most Intriguing Newcomer) (2020 – 2021)

Publications

1. C. Muir, B. Swaminathan, **A.K. Musaffar**, *In Situ Crack Opening Displacement Growth Rates of SiC/SiC Ceramic Matrix Composites*, **[Submitted]** Journal of the European Ceramic Society, 2022
2. J.B. Matthews, A.J. Welter, **A.K. Musaffar**, *The Flexible Logistics & Exploration (FLEX) Rover and Bucket Drum Excavation Tool*, Space Resources Roundtable XXII, 2022
3. Nathan Scheinkman, Bjorn Johnson, **A.K. Musaffar**, Adrian Agogino, *Design, Control, and Simulation of Tensegrity Based Kites*, NASA Technical Memo, 2022, NASA/TM-20220009943
4. B. Swaminathan, N.R. McCarthy, A.S. Almansour, K. Sevener, **A.K. Musaffar**, T.M. Pollock, J.D. Kiser, S. Daly, *Interpreting acoustic energy emissions in SiC/SiC minicomposites through modeling of fracture surface areas*, Journal of the European Ceramic Society,2021, https://doi.org/10.1016/j.jeurceramsoc.2021.06.030
5. **Musaffar A. K.**, Agogino A., *Scalability and Design of Six Rod Tensegrity Soft Robotic Structure*. NASA Technical Memo, 2021, NASA/TM-20210014844, https://ti.arc.nasa.gov/publications/20210014844/download/
6. **Musaffar A. K.**, Agogino A., *Rapid Prototyping of a Purely Tensional Flexible Tensegrity Robot*, NASA Special Publication, NASA/SP-2019-635, 2019
7. **Musaffar A.K.**, Scheinkman N., Kothapali T., Agogino A., *Application of Locomotion Patterns and Rapid Proto-typing of Tensegrity Robots*, NASA Special Publication, NASA/SP-2017-219550, 2017

Relevant Classes

Audited:

- CS61A: Structure and Interpretation of Computer Programs (UC Berkeley)
- Introduction to Programming with MATLAB (Vanderbilt University/Coursera)
- Machine Learning (Stanford University/Coursera)

Graduate Level:

- ME125EY/ME225EY: Special Topics in Biological Computing (Biology) (UCSB)
- ME125EY/ME225EY: Special Topics in Biological Computing (Controls) (UCSB)
- ME125ML/ME225ML: Special Topics in Machine Learning (UCSB)

Misc. Special Topics:

- ME125BL: Special Topics in Thermal Radiation (UCSB)

Self-Education:

- *The C Programming Language: 2nd Edition*

Hobbies

Outdoors: Edible plant foraging, Hiking, Camping, Overlanding, Gardening
Sports: Swimming, Soccer, Football
Music: Piano (self-taught)