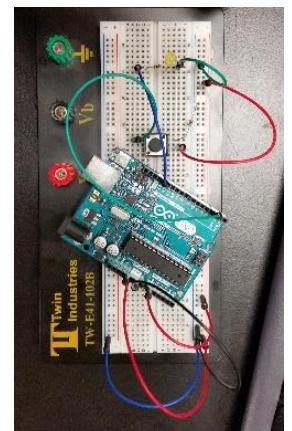
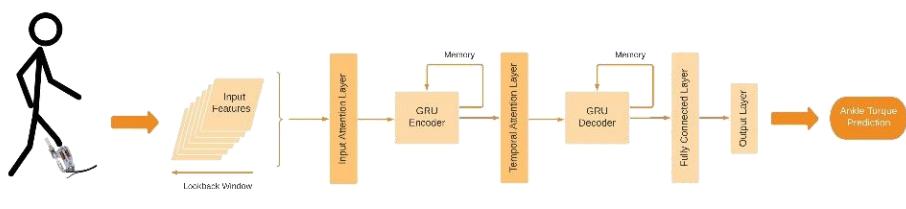
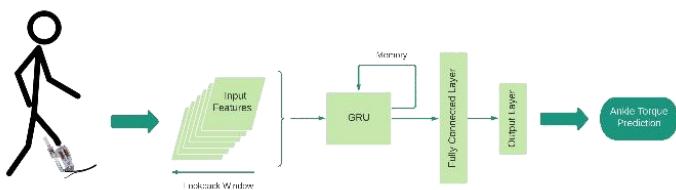
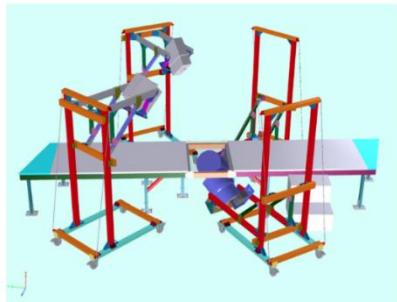
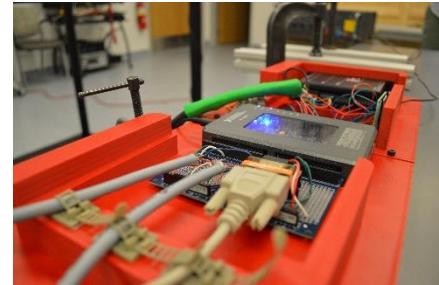
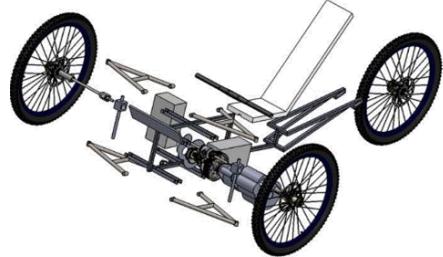


CHRIS PRASANNA

PROJECT PORTFOLIO



Mechanical Engineering • Mechatronics • Controls • Robotics

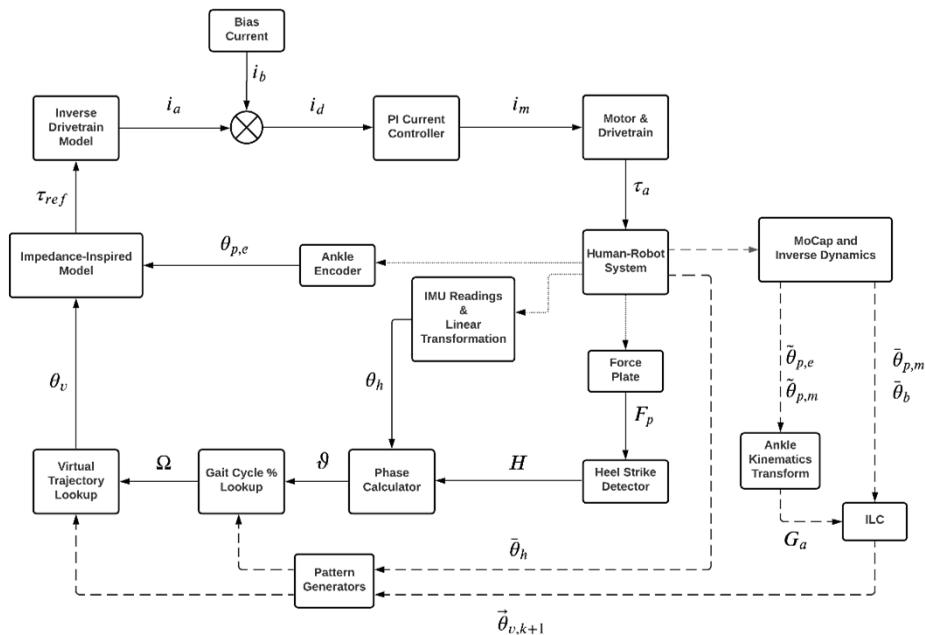
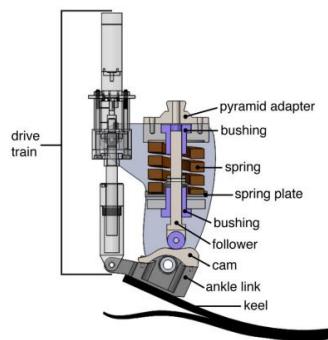
Robotic Ankle-Foot Prosthesis Controller

Master's Thesis



Invented a time-invariant and adaptive control strategy for a robotic ankle-foot prosthesis which significantly improved amputee walking symmetry

Executed bench tests, conducted human subject experiments, implemented a data-driven learning pipeline, and performed statistical analyses to evaluate the robotic prosthesis



Skills: Robotics, Mechatronics, Real-Time Adaptive Control, Electromechanical System Modeling, Rapid Control System Prototyping, Reliability Testing



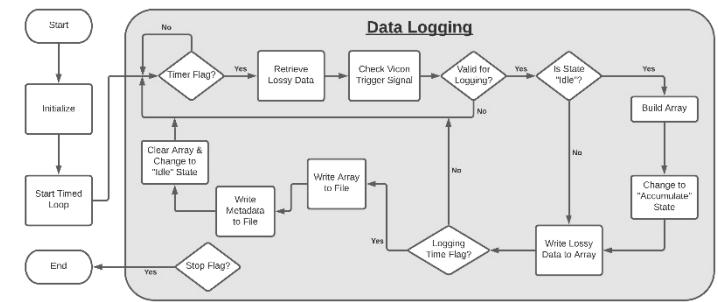
Real-Time Control Program Implementation

Master's Thesis

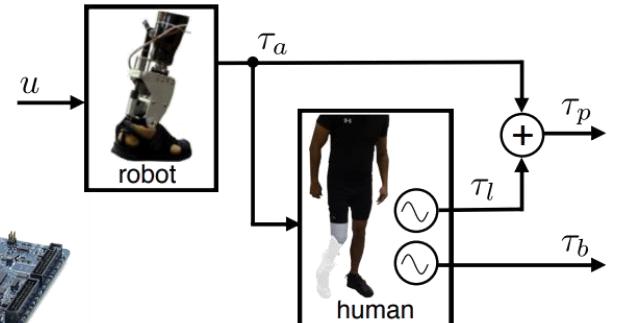
W COLLEGE OF ENGINEERING
UNIVERSITY of WASHINGTON

CLiMB
Center for Linkage and Mobility

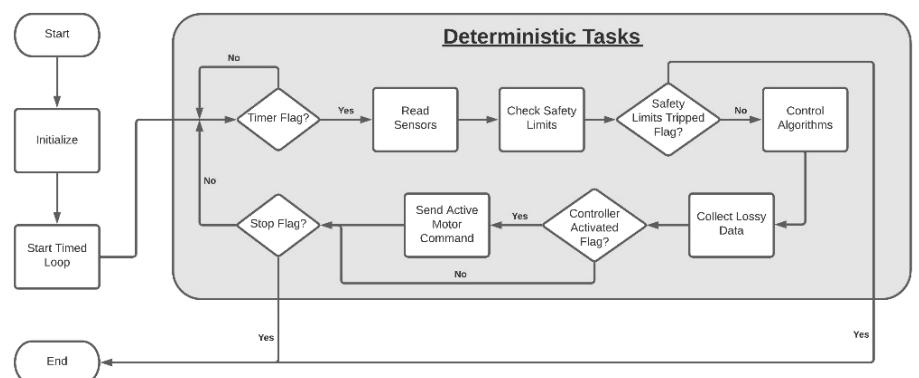
Designed an extensive and reliable real-time LabVIEW program responsible for robotic prosthesis system control, sensor fusion, filtering, wireless network communication, coordinate system transformations, data logging, and visualization



Successfully learned and implemented advanced control techniques such as iterative learning, robot model inversion, spectral methods, PCA, and real-time mechanical phase variables in order to achieve the best controller performance



LabVIEW



Skills: LabVIEW, Microcontrollers, Embedded Computing, Real-Time Control, DAQ, Sensor Integration, Digital Signal Processing, HMI/GUI Development

Embedded System Design & Fabrication

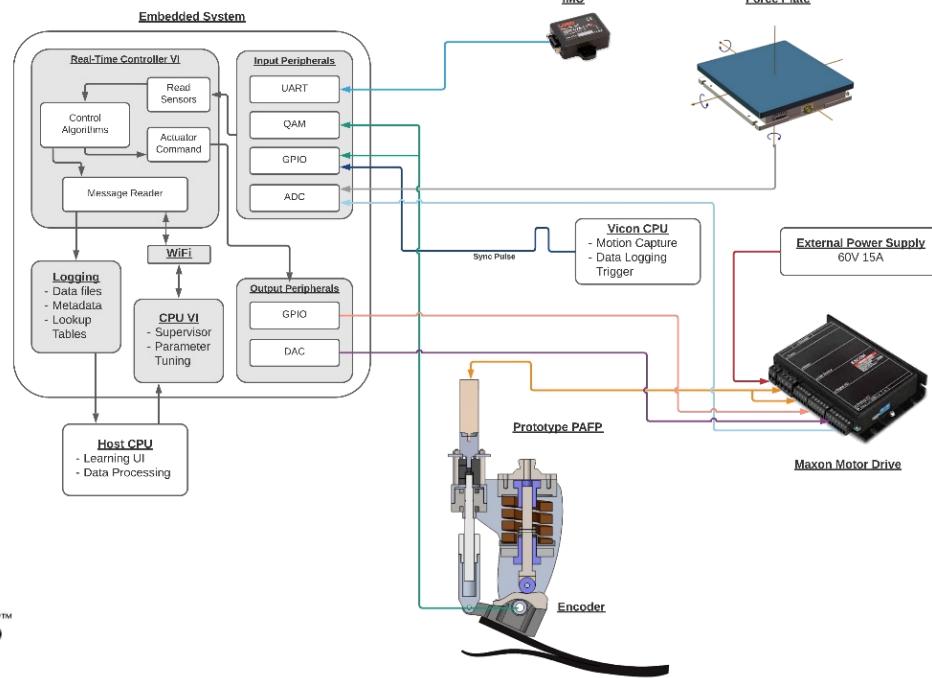
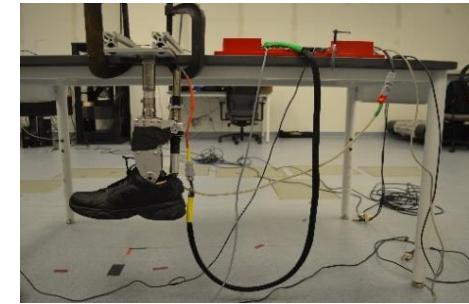
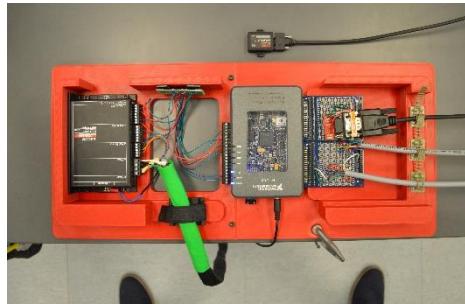
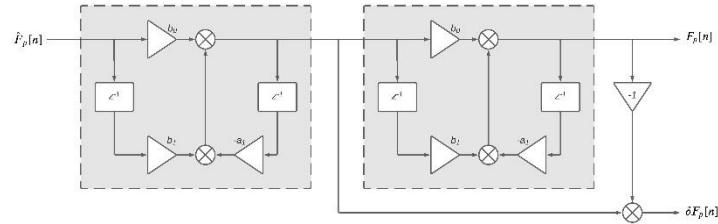
Master's Thesis

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Built and programmed a compact embedded system designed to handle real-time deterministic tasks, sensor fusion, digital and analog signal processing, multi-microcontroller communication, and low-level BLDC motor feedback control tasks

Designed and fabricated the 3D-printed housing structure, multiple sensor interfaces, soldered protoboard circuits, custom shielding, and wire strain relief mechanisms



Skills: 3D Printing, Machining, Troubleshooting, Serial Communication, Circuits, Soldering, BLDC Motor Control, Component Selection, Shielding

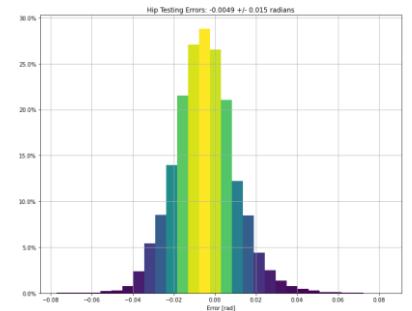
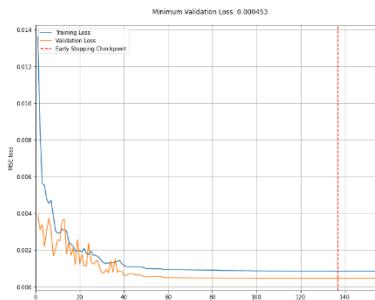
Deep Learning: Human-Robot Dynamics

Master's Thesis

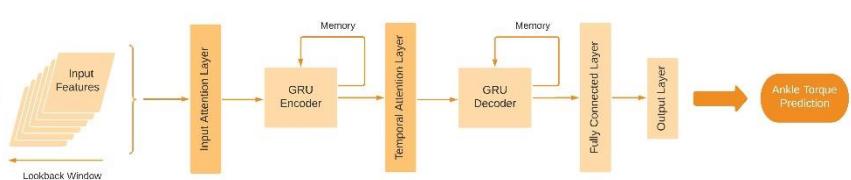
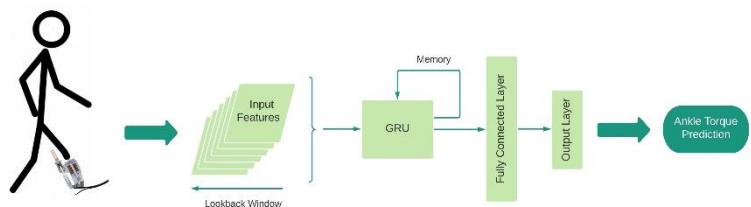
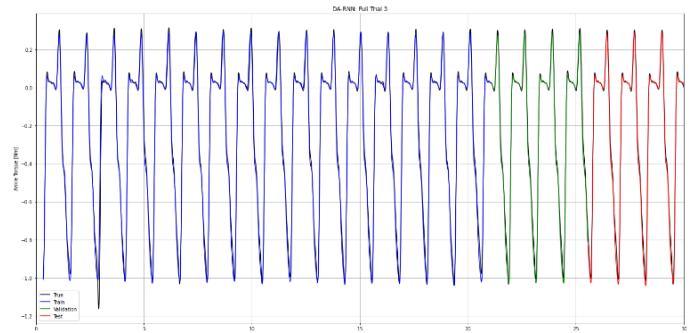
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Developed 3 deep neural network models (FFNN, GRU, DA-RNN) to accurately predict human-robot system dynamics for future prosthesis control methods



Implemented key deep learning techniques, including but not limited to, hyperparameter optimization (Optuna framework), attention mechanisms, parallel computing, mini-batches, normalization, data augmentation, validation, early stopping, additive Gaussian noise, and rolling lookback windows



Skills: Python, Pytorch, Hyperparameter Optimization, Dynamical System Modeling, Time Series Analysis & Forecasting, System ID, Feature Manipulation

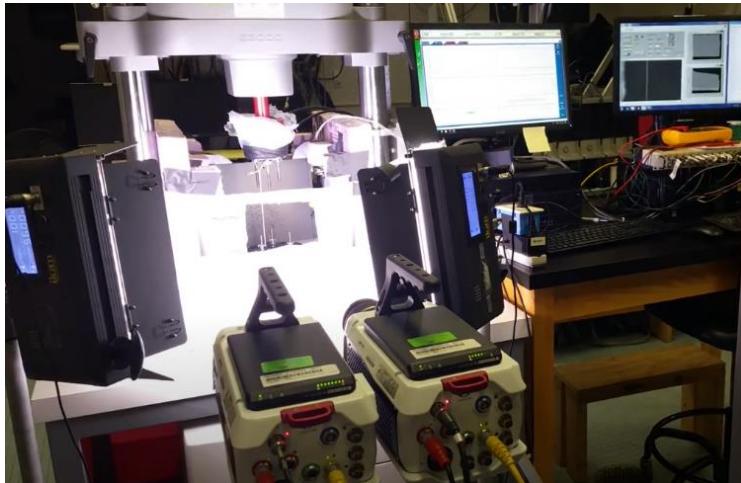


Automated Temperature Feedback Controller

Professional Experience

Created a closed-loop feedback controller for a mechanical testing environmental chamber using an Arduino, LabVIEW, thermal sensors, and heat lamps in order to reach and maintain a desired temperature for simulating biological conditions

This system effectively reduced steady state percent error to 3.5%



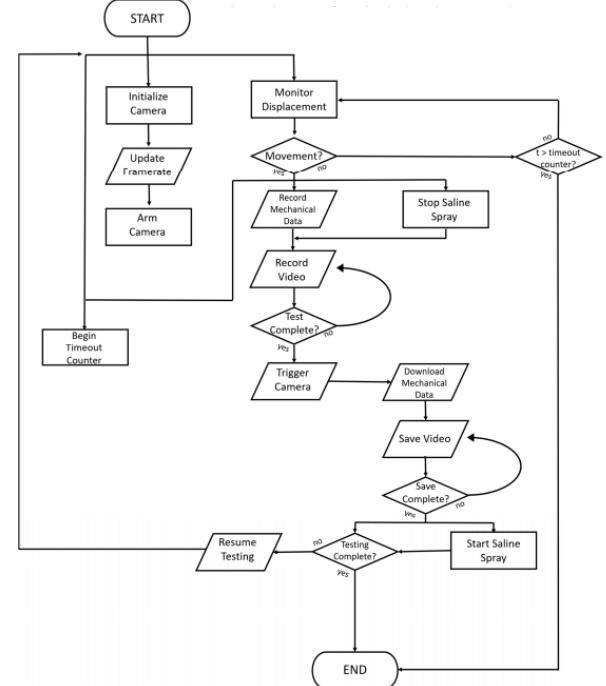
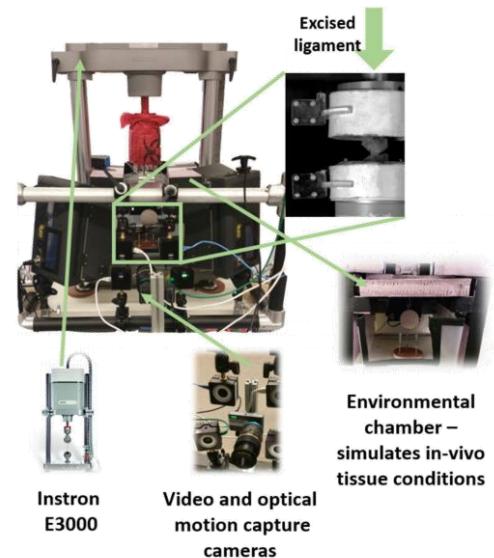
ARDUINO



Skills: Arduino, C/C++, Embedded Computing, LabVIEW, Automatic Control, Mechanical Testing, Sensors, Circuit Design, Fabrication, Soldering



CLiMB - Combining Ligament and Muscle Biomechanics



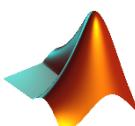
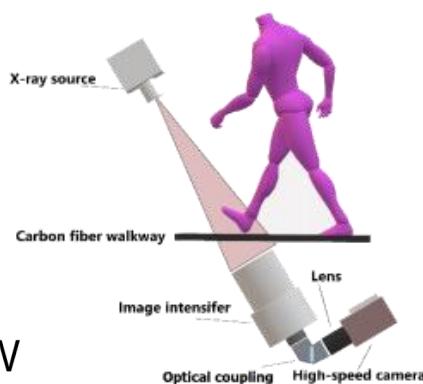
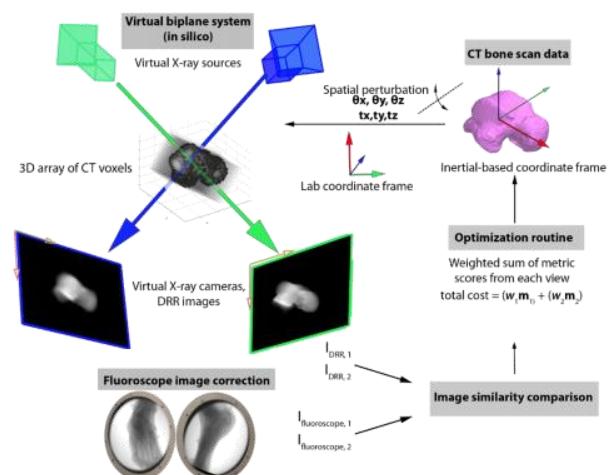
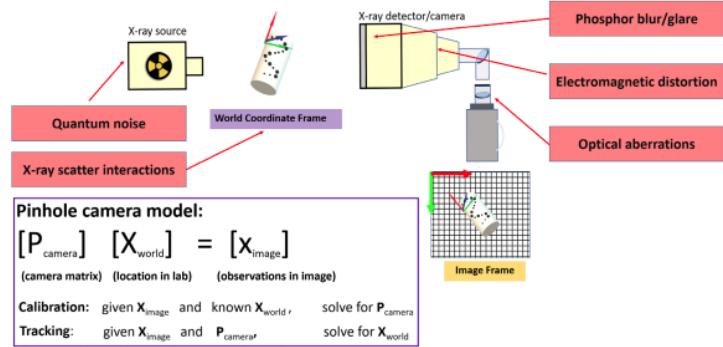


X-Ray Video-Based 3D Bone Motion Tracking

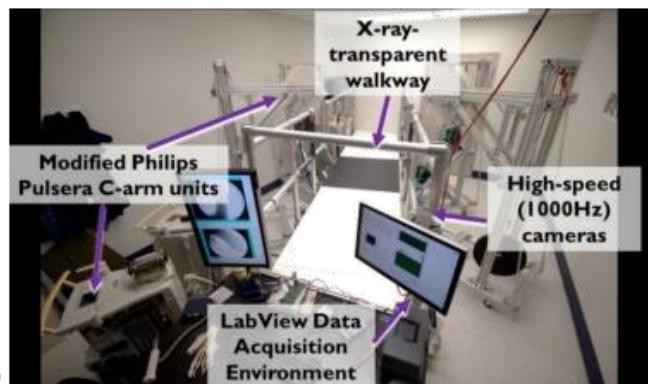
Professional Experience

Conducted research that aimed to reduce limb loss and developed novel techniques using X-rays, computer vision, and image processing techniques in order to better evaluate lower limb bone motion

Led and collaborated on mechanical design projects for unique laboratory equipment needs, including but not limited to, high-speed camera gantries and computer vision calibration objects



LabVIEW



Skills: Computer Vision, Video tracking, 3D Pose & Motion Estimation, Design, Machining, Signal Processing, MATLAB, LabVIEW, Data Analysis





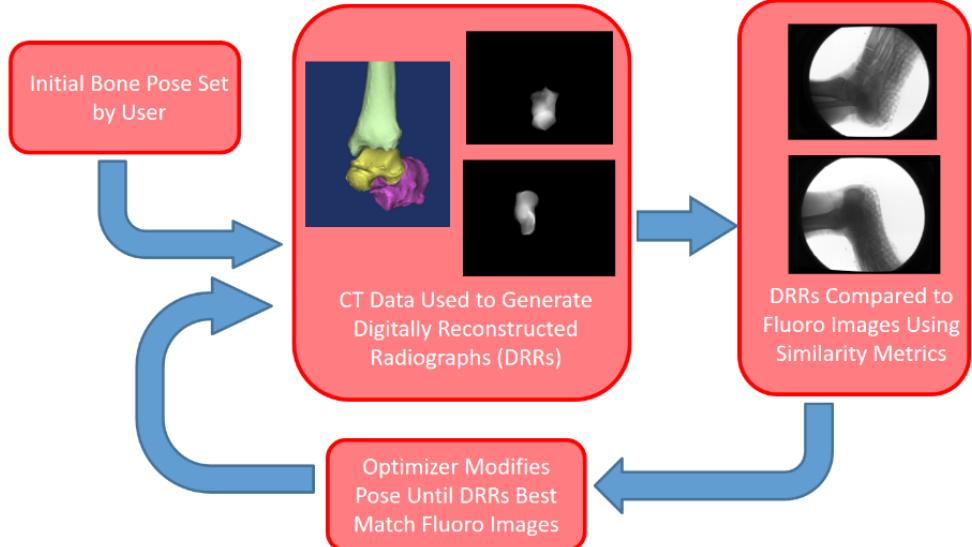
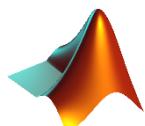
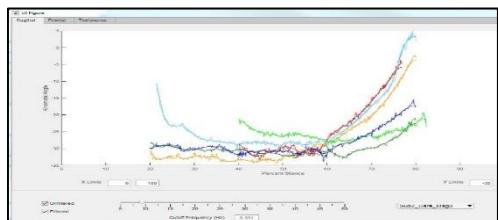
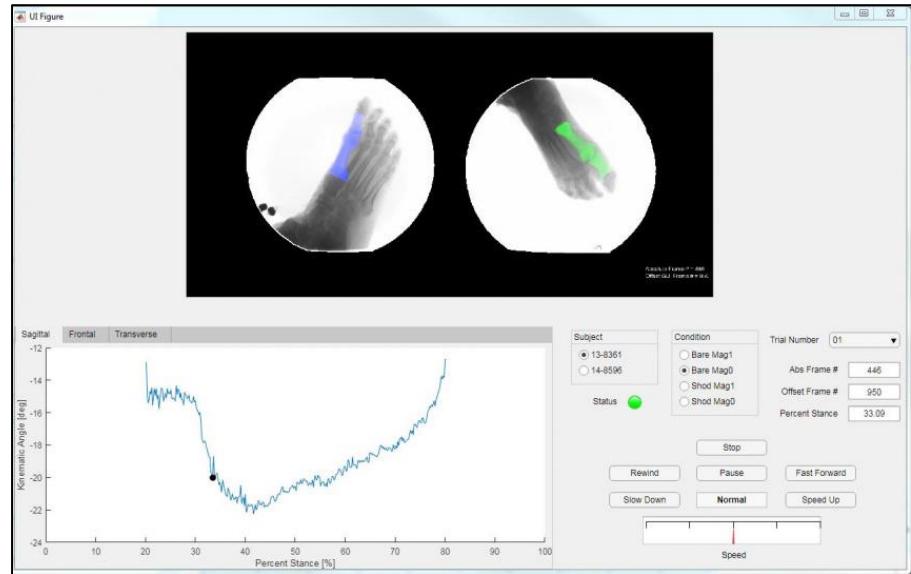
Video Processing & Motion Tracking Pipeline

Professional Experience



Implemented automated digital signal processing and quality control GUIs to X-ray video tracking and data analysis protocols

Significantly reduced errors and the amount of necessary manual data processing time



Skills: Signal Processing, GUI Design, MATLAB, Video Tracking, 3D Pose & Motion Estimation, Quality Control, Automation, Data Processing & Analysis

Automated Testing & Analysis Protocol

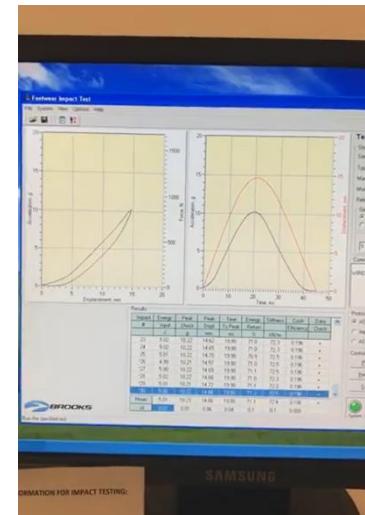
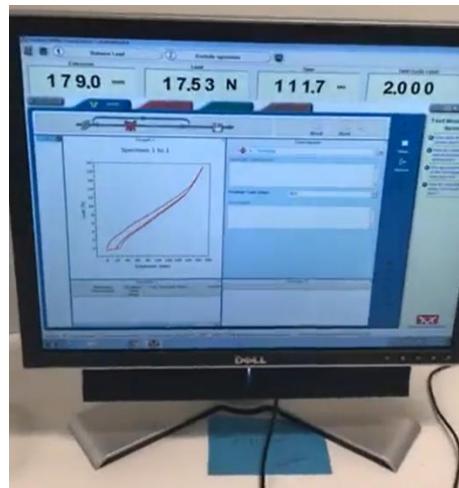
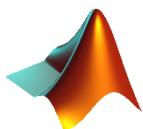
Professional Experience



Developed MATLAB Scripts that reduced the amount of time needed to complete the product testing and analysis pipeline by 66%



Reported biomechanical and mechanical testing results to a multidisciplinary and cross-functional team for future product development strategies



Skills: MATLAB, Protocol Development, Automation, Data Processing, Data Analysis, Mechanical Testing, Reliability Test Design & Analysis

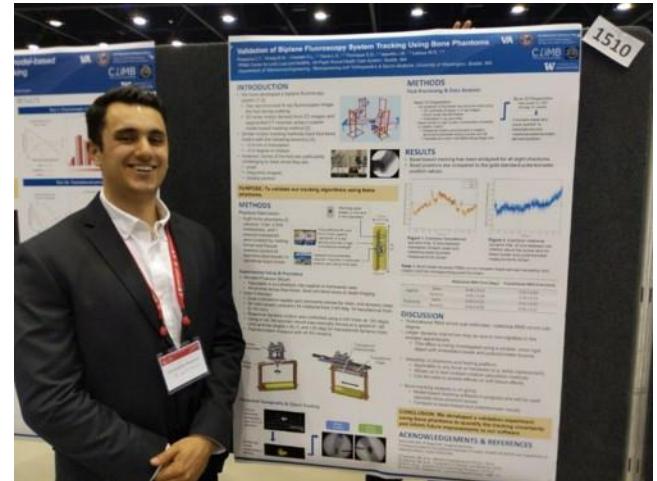
Conference Presentations

Professional Experience

Was selected to present my research at the following conferences:

- International Society of Biomechanics (2019)
- NW Biomechanics Symposium (2018)
- Young Investigator's Symposium (2018,2020,2021)

At NW Biomechanics Symposium, the Best Presentation Award was given to me by a team of judges which consisted of some of the field's leaders and top professionals



WESTERN
WASHINGTON UNIVERSITY
Northwest Biomechanics Symposium 2018
Certificate of Appreciation

Christopher Prasanna

In recognition for his outstanding performance in a
PODIUM PRESENTATION
During the 14th Northwest Biomechanics Symposium
Western Washington University, Bellingham, WA
May 5, 2018

LaTeX

Office



Best Presentation
Award

Skills: Public Speaking, LaTeX, Effective Communication, Technical Writing, Research, Data Analysis & Visualization, MS Word, MS PowerPoint

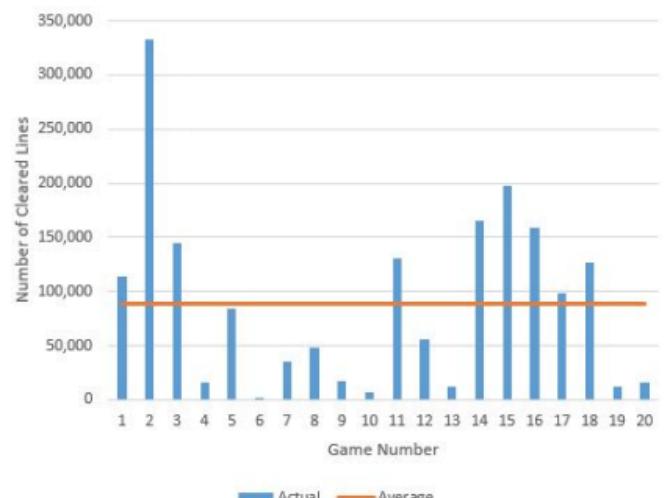
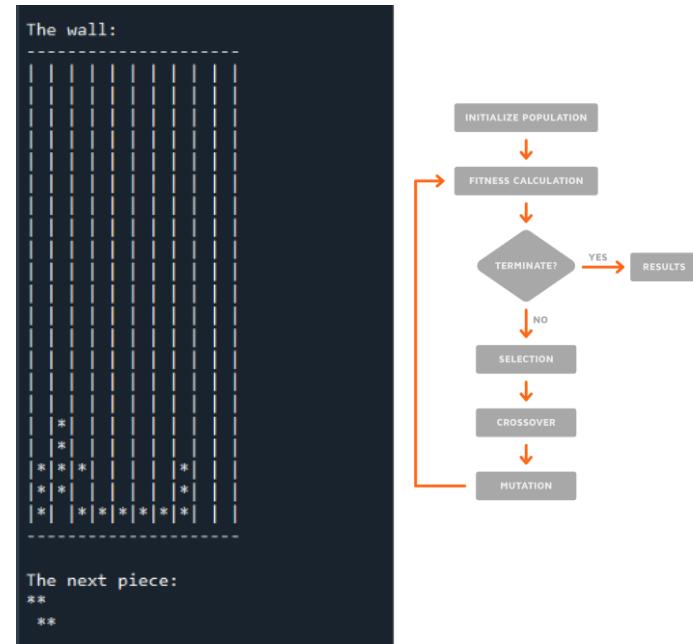
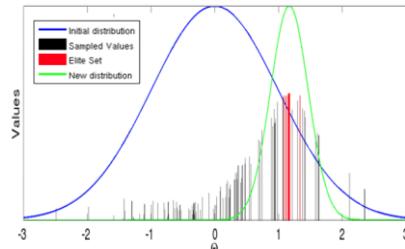
Artificial Intelligence: Tetris Player

Project

Created a Tetris-playing AI agent in Python that cleared over 88,000 lines on average before getting a game over. To compare, the Guinness Record for lines cleared by a human player is 4,988

Implemented two reinforcement learning methods (genetic algorithm and cross-entropy method) to train the Tetris-playing AI learner

Devised an additional AI agent that learned and optimized based on both the current piece as well as the next piece ahead. This AI was able to play a single game for 4 days straight without a game over



Skills: Python, Reinforcement Learning, Algorithm Implementation, Black Box Optimization, Genetic / Evolutionary Algorithms, Feature Selection

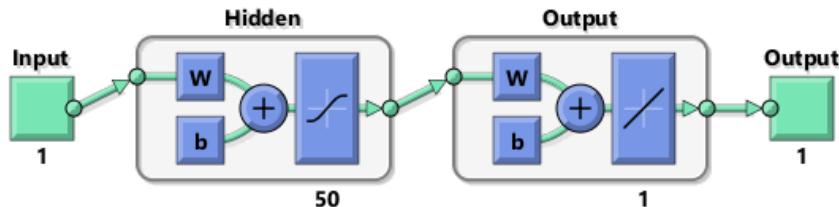
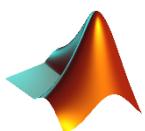
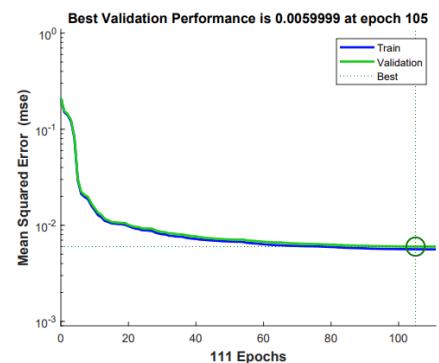
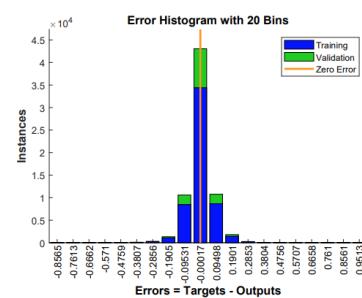
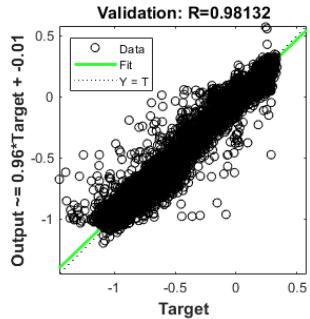
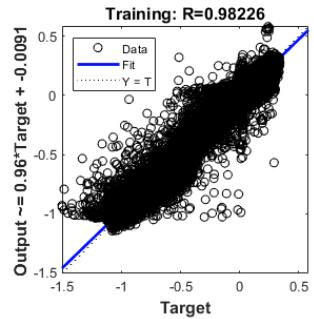
Machine Learning: Human-Robot Dynamics

Project



Used previously collected wearable sensor and control signal data from amputee subjects to train multiple machine learning models in order to predict human-robot dynamical system behavior

Programmed the following data-driven regression models using MATLAB's toolboxes: shallow neural networks, random forests, least squares regression, and sparse regression



Skills: MATLAB, Machine Learning, Neural Networks, Least Squares Regression, Optimization, System Identification, Data Analysis, Feature Extraction



Cerebral Palsy Rehabilitation Product Design

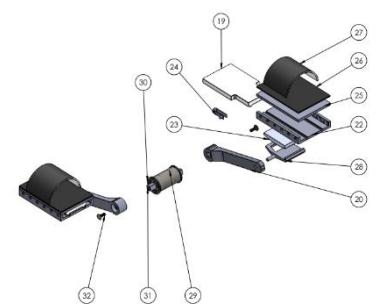
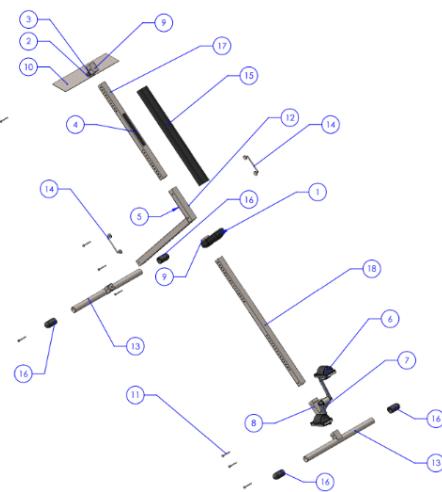
Undergraduate Capstone Project



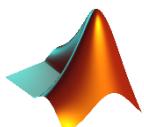
CAL POLY



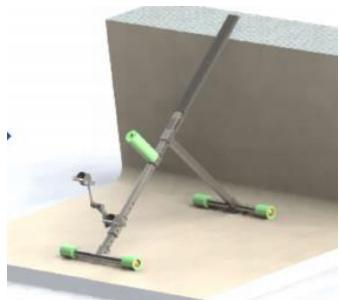
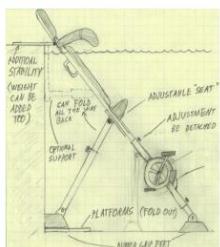
Collaborated with three other young engineers to design and build an underwater stationary cycle. This device is used by the United Cerebral Palsy's clients in order to practice their motor skills and improve their airflow



Extensive time spent in the machine shop using CNC mills, welding arcs, drill presses, industrial saws, and surface finishing tools



SOLIDWORKS



Skills: Rapid Prototyping, DFMA, DFMEA, GD&T, Product Design & Development, Machining, CAD (SOLIDWORKS), 3D Printing, Reliability Testing



Electric Off-Road Trike Design

Project

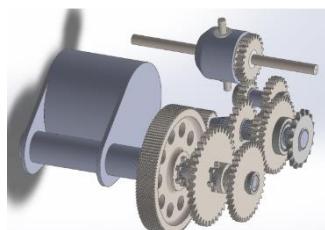
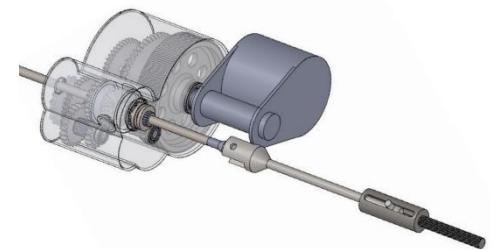
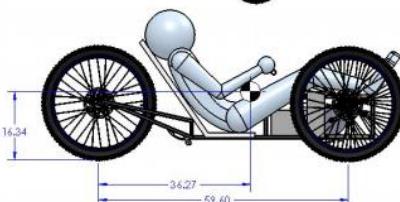
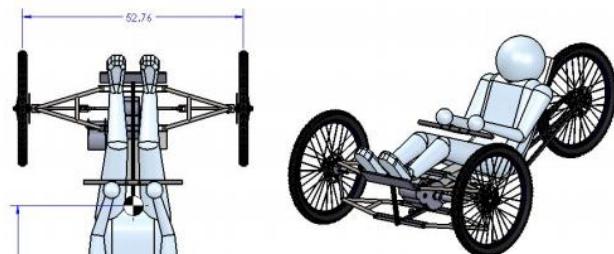
Collaborated with a team of six to design an all-wheel drive, fully electric off-road tricycle for paraplegic users

Primarily responsible for designing the rear axle, drivetrain, chain, and sprocket assemblies as well as selecting suitable mechanical components from online vendors

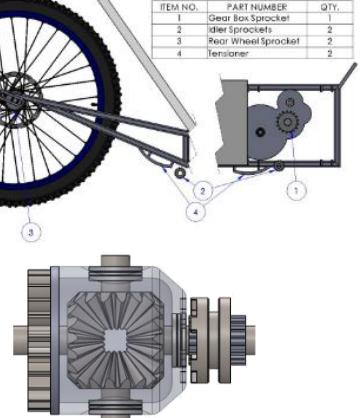
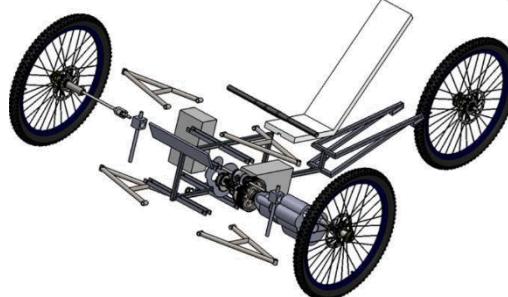
Designed complex parts and large assemblies for the tricycle's frame, electrical components, and powertrain system using SOLIDWORKS



CAL POLY



ITEM NO.	PART NUMBER	QTY.
1	Gear Box Sprocket	1
2	Idler Sprockets	2
3	Rear Wheel Sprocket	2
4	Tensioner	2



SOLIDWORKS

Skills: CAD (SOLIDWORKS), GD&T, Design, Component Selection, Safety Factors, Electromechanical System Modeling, Powertrain Design

Special Olympics Award Stand Fabrication

Project



Special Olympics
Southern California

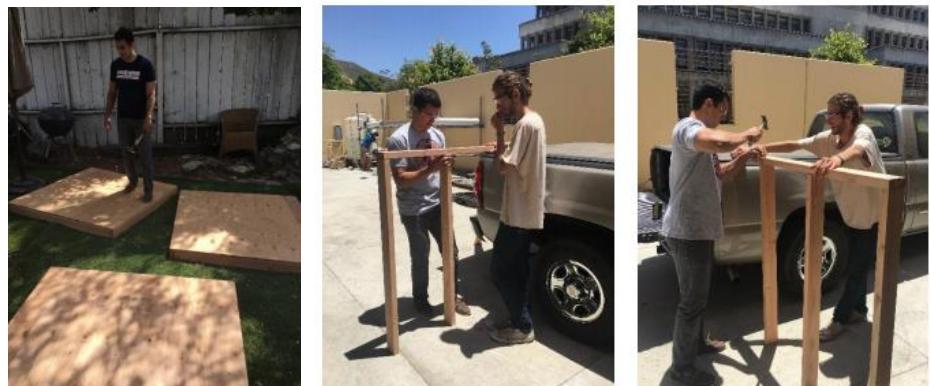


CAL POLY

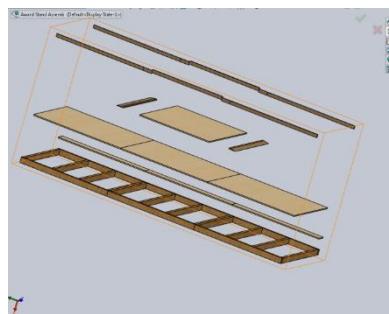
Fabricated a wheelchair-accessible and load-supporting award stand for a local Special Olympics organization



Conducted DFMA to reduce production time and constructed final design drawings using GD&T standards



Corresponded with a small engineering team and the client in order to ensure a successful product launch



SOLIDWORKS

Skills: CAD (SOLIDWORKS), DFMA, GD&T, Design, Reliability Testing & Analysis, Design Verification, Machining, Woodworking, Vendor & Client Coordination

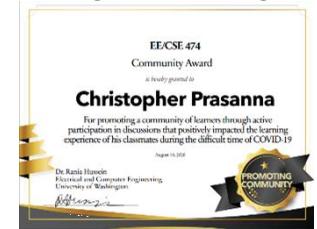
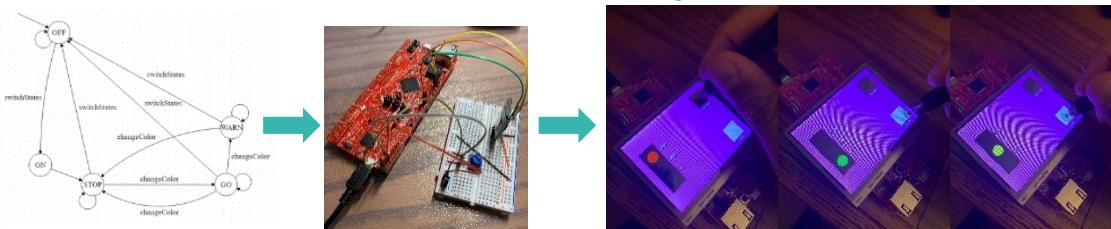
Relevant Graduate Coursework

M.S. in Mechanical Engineering



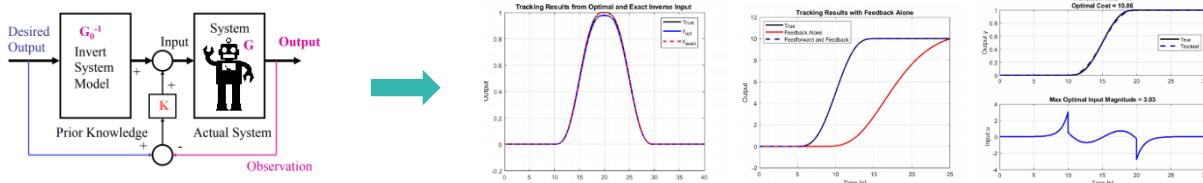
Embedded Systems

Built various real-time embedded systems from the ground up using a microcontroller (TI Tiva/Stellaris), register datasheets, and C programming



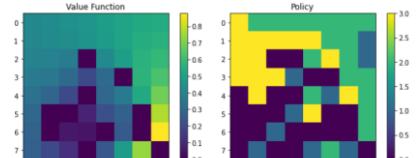
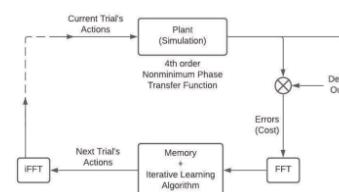
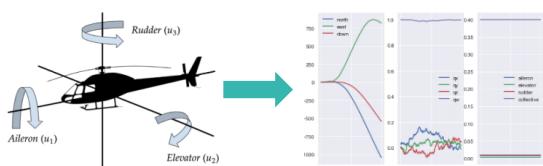
Feedforward & Inversion-Based Control

Integrated feedforward control laws with feedback-based controllers to improve precision output tracking when feedback alone has limitations



Modern Adaptive Control & Reinforcement Learning

Built adaptive software in Python that applied modern machine learning and optimization techniques to robotic decision-making



Other Advanced Courses: Data-Driven Modeling & Control, Numerical Methods & Computing, Linear Systems, Adv. Dynamics & Vibrations, Automatic Control

Hobbies & Interests

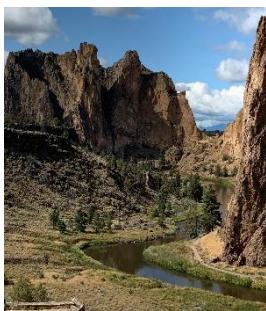
Hiking



Cooking



Travel



Sports & Fitness

