







# CHRIS PRASANNA

 [chrisprasanna.github.io](https://github.com/chrisprasanna)  
 [linkedin.com/in/chrisprasanna/](https://www.linkedin.com/in/chrisprasanna/)

 [github.com/chrisprasanna](https://github.com/chrisprasanna)  
 [c.prasanna95@gmail.com](mailto:c.prasanna95@gmail.com)

 425-772-0656  
 Seattle, WA

## SUMMARY

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Multi-disciplinary engineer passionate about advancing robotics and artificial intelligence to assist humans. Hands-on experience developing real-world robotic systems and highly proficient in control systems, programming, machine learning, and reinforcement learning.

## EDUCATION

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### University of Washington

Seattle, WA

Master of Science in Mechanical Engineering

2019-2022

- **Thesis:** Adaptive Symmetry Learning and Data-Driven Predictive Models for Personalized Control of Robotic Ankle-Foot Prostheses
- **Curriculum Concentration:** Mechatronics, Controls, and Robotics
- **GPA:** 3.9/4.0

### California Polytechnic State University (Cal Poly)

San Luis Obispo, CA

Bachelor of Science in Mechanical Engineering

2013-2017

- **Capstone:** Cerebral Palsy Rehabilitation Product Design & Fabrication
- **GPA:** 3.5/4.0

## PROFESSIONAL EXPERIENCE

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### Robotics & Controls Researcher

U.S. Department of Veteran Affairs, Seattle, WA

Center for Limb Loss & Mobility

7/2019 – Present

- Developed novel control algorithms for a robotic prosthetic limb, which significantly improved the mobility of veteran amputees and reduced loading effects associated with osteoarthritis
- Improved human-prosthesis system behavior prediction accuracy by 90% using wearable sensor signals, deep learning (PyTorch), and neural network architecture optimization (Optuna)
- Integrated an adaptive iterative learning algorithm that personalizes and optimizes robot trajectories based on the human user's motion
- Programmed LabVIEW software responsible for real-time control, state estimation, signal processing, wireless network communication, data acquisition, and visualization
- Built a compact embedded system that encompassed sensor interfaces, custom circuit boards, and microcontrollers within a 3D-printed case
- Conducted simulations, bench tests, human subject data collections, and statistical analyses to evaluate the prosthesis controller and its benefits

### Research Engineer

U.S. Department of Veteran Affairs, Seattle, WA

Center for Limb Loss & Mobility

2/2018 – 6/2019

- Led and collaborated on mechanical design projects for unique laboratory equipment needs, including but not limited to, a material potting jig for Instron testing, camera gantries, and an environmental chamber
- Created an embedded controller in C for a thermal chamber, which successfully controlled environmental conditions within 3.5% of the desired condition
- Built automated signal processing & outlier detector algorithms in MATLAB for the large volumes of data from experiments
- Analyzed, reviewed, and debugged other engineers' code across multiple projects and research areas
- Mentored 4 undergraduate students through design process troubleshooting, project management challenges, and device testing protocols

**Research & Development Engineering Co-Op Intern**

Human Performance Lab Team

Brooks, Seattle, WA

6/2016 – 12/2016

- Executed multiple successful engineering projects related to product research and testing while preparing cross-divisional presentations and documentation for the company
- Developed MATLAB programs that helped automate the product testing and analysis pipeline, effectively lowering protocol completion times by 66%
- Reported testing results and analyses to a multidisciplinary and cross-functional team for future product development strategies
- Consistently processed experimental data and completed product testing protocols days ahead of schedule
- Quickly learned to operate equipment and software programs such as instrumented treadmills, Instron testing machines, 3D motion capture system software, and Tableau Software

**Project Engineering Intern**

Street, Stormwater, and Traffic Engineering Divisions

City of Lynnwood, Lynnwood, WA

6/2017 – 9/2017

- Formulated, executed, and completed a city project plan 2 months ahead of schedule
- Demonstrated motivation and a willingness to learn by seeking out additional traffic engineering projects outside my assigned department and independently learning software such as Python and ArcGIS
- Excelled working both independently and in team environments on multiple projects simultaneously across different departments

**Mechanical Engineering Department Tutor**

Cal Poly, Mechanical Engineering Department

Cal Poly, San Luis Obispo, CA

9/2015 – 12/2017

- Mentored and assisted 5-10 undergraduate students per day through their various challenges related to academics, curriculum planning, and collegiate life
- Effectively articulated difficult concepts related to statics, dynamics, mechanics, and thermodynamics
- Demonstrated strong interpersonal, time management, leadership, and communication skills

**PROJECTS & COMMUNITY ENGAGEMENT**

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**Data-Driven Robot Controller Training**

Collaborative Research Project

U.S. Department of Veteran Affairs, Seattle, WA

8/2021 – Present

- Collaborated with multiple researchers & engineers to build a ML training, and evaluation pipeline for modeling human-robot systems
- Implemented deep learning techniques (PyTorch) to create accurate system simulations based on sensor data from field experiments
- Led & documented reviews to improve code quality & performance
- Currently working toward utilizing the machine learning-based simulations to train highly accurate and responsive robotic prosthetic control systems without any safety risks to the user

**Tetris-Playing AI**

Graduate Software Development Project

University of Washington, Seattle, WA

9/2020 – 12/2020

- 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 lines
- Implemented two reinforcement learning methods (genetic algorithm and cross-entropy method) to train the Tetris-playing AI learner
- Constructed algorithms, programmed training scripts, and simulated Tetris games using Python and OpenAI Gym
- Identified and tested multiple sets of state features and heuristics to include in the training algorithm's parameterized optimization function

## **Cerebral Palsy Rehabilitation Product Design**

Undergraduate Senior Capstone Design Project

Cal Poly, San Luis Obispo, CA

1/2017 – 12/2017

- 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 to practice their motor skills and improve their airflow
- Performed detailed simulations and analysis using MATLAB to validate the product's design
- Constructed a detailed design report which includes a description of the design process, discussion of our research, engineering analysis, and a final design justification
- Built the product using machining processes such as CNC milling, drilling, welding, and finishing
- Communicated with sponsors and vendors to ensure that the design specifications met the client's needs
- Thrived in a rapid development environment with short timelines, multiple tasks, and a limited budget

## **Electric Off-Road Trike Design Project**

Undergraduate Design Project

Cal Poly, San Luis Obispo, CA

1/2016 – 4/2016

- Collaborated with a team of six to design an all-wheel drive, 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
- Implemented factor of safety and effective gear ratio calculators in MS Excel for rapid design iteration
- Produced a concept definition and design report which includes a description of the development process, discussion of performance, results achieved, and a final design description and justification

## **Special Olympics Design Project**

Special Olympics Southern California

San Luis Obispo, CA

4/2017 – 6/2017

- Fabricated a durable and wheelchair-accessible 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

## **TECHNICAL SKILLS**

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### **Controls, Mechatronics & Robotics**

Real-Time Adaptive Control, Embedded Computing, Electromechanical System Modeling, Modern Control, Feedforward Control, Signal Processing, State Estimation, Impedance Control, Iterative Learning Control

### **Hardware**

Hardware-in-the-Loop Testing, Microcontrollers, 3D Printing, Embedded System Design, DAQ, Sensors, Actuators, Machining (CNC, Mill, Lathe), Shielding, Soldering, Circuit Prototyping, Serial Interfaces

### **Programming & Software Tools**

Python, LabVIEW, C, C++, PyTorch, Arduino, MATLAB, Object Oriented Programming, Optuna, Git, CAD (SOLIDWORKS), Simulink, Pandas, LM Flash Programmer, HTML, CSS, Abaqus, Data Structures

### **Product Design, Development, & Testing**

Rapid Prototyping, DFMA, GD&T, Component Selection, Materials Testing, Physics, Lagrangian Mechanics, Protocol Development, Supplier/Vendor Coordination, Safety Testing, Bench Testing

### **Data Science**

Deep Learning, Machine Learning, Reinforcement Learning, Time Series Analysis & Forecasting, Optimization, System Identification, Evolutionary Algorithms, Data Analysis, Feature Engineering

## **HONORS & AWARDS**

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**Best Podium Presentation Award**, Northwest Biomechanics Symposium

Summer 2018

**Community Leadership Award**, Embedded Systems Course

Summer 2020

**Dean's List**, California Polytechnic State University

Fall 2013-Winter 2017

## JOURNAL ARTICLES IN PREPARATION

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**Prasanna C**, Anderson A, Realmuto J, Rombokas E, Klute G. A Data-Driven and Personalized Symmetry Controller for Robotic Ankle-Foot Prostheses. (In preparation for IEEE Transactions on Neural Systems and Rehabilitation Engineering)

**Prasanna C**, Realmuto J, Anderson A, Rombokas E, Klute G. Using Deep Learning Models and Wearable Sensors to Predict Prosthetic Ankle Torques. (In preparation for IEEE Transactions on Neural Systems and Rehabilitation Engineering)

Berardo-Cates A, **Prasanna C**, Kindig M, Stender C, Ledoux W, Iaquinto J. Quasi-Linear Viscoelastic Characterization of Small Foot and Ankle Ligaments. (In preparation for Journal of Biomechanics)

Chastain K, Kindig M, **Prasanna C**, and Ledoux W. Construction of Bone Phantoms for Biplane Fluoroscopy Validation. (In preparation for Journal of Biomechanical Engineering)

## CONFERENCE PRESENTATIONS

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**Christopher Prasanna**, Anthony Anderson, and Glenn Klute. Towards Learned Personalized Symmetry Control for Powered Ankle Prostheses. VA Center for Limb Loss & Mobility Young Investigators Symposium, 2021 (*Podium Talk*)

**Christopher Prasanna**, Jonathan Realmuto, Krista Cyr, and Glenn Klute. Towards an Adaptive Neural Network-Based Predictive Control Strategy for Individuals with Transtibial Amputation Carrying Loads. VA Center for Limb Loss & Mobility Young Investigators Symposium, 2020 (*Podium Talk*)

**Christopher Prasanna**, Matthew Kindig, Kalle Chastain, Levi Davis, Eric Thorhauer, Joseph Iaquinto, and William Ledoux. Validation of Biplane Fluoroscopy System Tracking Using Bone Phantoms. International Society of Biomechanics Conference, 2019 (*Poster*)

**Christopher Prasanna**, Eric Thorhauer, Matthew Kindig, Joseph Iaquinto, and William Ledoux. First Metatarsophalangeal Joint Kinematics Measured Using Biplane Fluoroscopy. Northwest Biomechanics Symposium, 2018 (*Podium Talk*)

**Christopher Prasanna**, Eric Thorhauer, Matthew Kindig, Joseph Iaquinto, and William Ledoux. Bone Tracking Using a Biplane Fluoroscopy System: Approaches, Challenges, and Potential Solutions. VA Center for Limb Loss & Mobility Young Investigators Symposium, 2018 (*Podium Talk*)

## ADVANCED COURSEWORK

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Modern Optimal Adaptive Control & Reinforcement Learning | Data-Driven Modeling & Control  
Feedforward Control | Numerical Methods & Computing | Embedded Systems | Linear Systems  
Advanced Dynamics & Vibrations | Classical Automatic Control | Biomechanics | Mechanical Design