Shaun FEDRICK
Mechatronics Engineer

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Professional Experience

Jan 2022 – current | **Mechatronics Engineer | Motion Planning and Controls , ASML, Wilton,Ct**

Currently I work to implement motion planning software onto a 6dof robotic reticle stage. This involves simulating the dynamics of the stage and creating/implementing appropriate algorithms to control the stage.

- Designed, developed, and tested a software algorithm that used numerical optimization techniques to optimize motor control parameters for reluctance actuators given robotic force data. Data was collected using a HIL (hardware in the loop) approach and analyzed in matlab. The control scheme was implemented in simulink, and the software algorithm was implemented on the machine using a combination of matlab and python.
- Refactored a code base designed to simulate the dynamics of a 6 dof robotic reticle stage. Transfered this code base into a modern version control system (git) from svn to aid software collaboration and tracking.
- Designed, developed, and tested a software algorithm that used the kinematics of a robotic stage to prevent thermal stresses from damaging the motors.
- Lead the development of two new mechatronic tools that will enable automatic testing of electronics,hardware, and control methodologies of a 6 dof robotic reticle stage.

Robotics | controls | Machine Learning | Data Analysis | Tensor flow | Pytorch | Scipy | Simulation | Python | C++ | Linear Algebra | Statistics | Agile

May 2021 – Dec 2021 | **GRASP Lab | Graduate Student Researcher (Robotics) , University of Pennsylvania, Pennsylvania**

I used a phase change material coupled with a heated insert to create a latching mechanism to add directionality to an origami robot. I then designed and implemented a controller in C++ that ran on a micro controller in real time to control the mechanism .

- Designed and optimized a nonlinear controller using ILC (Iterative Learning Control)
- wrote a monte carlo application in python to pick design parameters for an origami robot.
- Wrote a controller in C++ to control the latching mechanism.
- See DOI:10.1109/ICRA40945.2020.9196534 for more information on the robot.

C++ | Python | Controls | Rapid Prototyping | Git | Docker | Data Analysis | Robotics

December 2018 – May 2020 | **Fluid dynamic research | Student Researcher, Haverford College and University of Pennsylvania, Pennsylvania**

I worked in collaboration with University of Pennsylvania and Haverford College to investigate the way Non-Newtonian effects impacted lubrication forces within a fluid.

- Used Python to perform data analysis on real word data to determine the dynamics of a complex non-newtonian fluid system.
- Analyzed and tracked mechanics of a sphere moving through a fluid using OpenCV.

OpenCV | Python | Computational Physics | Computer Vision | Rapid Prototyping

December 2016 – May 2019 | **Digital Scholarship | Website designer, Haverford College, Pennsylvania**

I worked on https://archivogam.haverford.edu/en/, a website designed to connect persons illegally detained and forcibly disappeared in Guatemala during the Civil War with friends and relatives.

- Wrote the front and back end of Home and Images Section of Archivo Gam using django.
- Implemented a panning zoom feature and a person search feature.

Python | Linux | Django | git | command line

Education

December 2021 – January 2020 | **University of Pennsylvania | Mechatronics and Robotic Systems , (Masters of Science in Engineering), Philly,PA**

- Mechatronic and Robotics engineering master's student.

Robotics | Mechatronics | Controls | Machine Learning | Computer vision | Electrical design | Sensors

December 2020 – August 2016 | **Haverford College| Physics , B.S, Haverford,PA**

- Fluid dynamic research; Thesis : Touch Down of a Sphere in Viscoelastic Media

Physics | Math | Dynamics | Mechanics | Computational Physics | Coding | Problem Solving | Expirementation

Projects

Learning inverse kinematics

Shaunfedrick.com/portfolio

One of the projects I undertook involved addressing the intricate challenges posed by the inverse kinematics problem in robotics, utilizing machine learning techniques. The project was divided into two main phases. The first phase involved training an artificial neural network (ANN) to solve the inverse kinematics problem. The second phase shifted focus to addressing whether given position and orientation data points were feasible within the robot arm's workspace. This was achieved through unsupervised clustering methods, including Gaussian Mixture Models (GMM) and k-means clustering.

python | pytorch | tensorflow | machine learning | robotics | kinematics

Holonomic Semi autonomous RC Car

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I undertook the development of a Holonomic Semi-autonomous RC Car, a project aimed at creating a versatile robotic vehicle capable of navigating dynamically while performing tasks in a controlled environment. The project incorporated mechanical design, electronics integration, software development, and functional testing to achieve its objectives.

C++ | Javascript | Microcontrollers | Controls | Electronics | Rapid prototyping

6 DOF Path Planning and Control of Serial linked manipulator

Shaunfedrick.com/portfolio

The project aimed to develop software for a 6dof serial manipulator capable of picking, placing, and manipulating both dynamic and static blocks. The primary challenges included aligning blocks correctly for optimal grip, dealing with block orientations, and developing strategies to topple an opponent's stack.

python | Ros | Gazebo | Kinematics | Dynamics