

# Shaun FEDRICK

## Mechatronics Engineer

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## PROFESSIONAL EXPERIENCE

Jan 2022 current	<b>Mechatronics Engineer   Software Algorithms and Motion Control , ASML, Wilton,Ct</b> Currently, I work to implement robotic software onto a 6dof robotic reticle stage. This involves designing/implementing perception algorithms, simulating the dynamics of the stage, and designing/implementing other appropriate software algorithms to help control the robotic stage. <ul style="list-style-type: none"><li>› Developed a computer vision algorithm that took 3d scans of moving wire ducts undergoing lifetime cycling and calculated the amount of wear the wires experienced from the scan movements. This algorithm was then utilized to create a predictive model for when ducts in the field will require replacement.</li><li>› 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 python. The software algorithm was implemented on the machine using a combination of Matlab and Python.</li><li>› Made a algorithm that processed video data of a robotic stage taking movement scans and extracted the shape of the moving wires on the platform to facilitate mechanical design optimization.</li><li>› Performed regression testing for new motor calibration software module, and wrote scripts to automate testing and analysis.</li><li>› Created shell scripts to facilitate large scale automation of testing and experimentation on the robotic stage.</li></ul> <p>Computer vision Machine Learning Data Analysis Tensor flow Pytorch Scipy Simulation Python C++ Linear Algebra video processing shell scripts</p>
May 2021 Dec 2021	<b>GRASP Lab   Graduate Student Researcher (Robotics) , UNIVERSITY OF PENNSYLVANIA, Pennsylvania</b> Designed and implemented a controller in C++ that ran on a micro controller in real time to add directionality to an origami robot. <ul style="list-style-type: none"><li>› Implemented a monte carlo algorithm in python to pick design parameters for an origami robot.</li><li>› Wrote a controller in C++ to control the latching mechanism that added directionality to the robot.</li></ul> <p>C++ Python Controls Rapid Prototyping Git Docker Data Analysis Robotics</p>
December 2018	<b>Fluid dynamic research   Student Researcher, HAVERFORD COLLEGE AND UNIVERSITY OF PENNSYLVANIA, Pennsylvania</b>
May 2020	I worked in collaboration with University of Pennsylvania and Haverford College to investigate the way Non-Newtonian effects impacted lubrication forces within a fluid. <ul style="list-style-type: none"><li>› Used video processing and computer vision techniques to analyze and track the mechanics of a sphere moving through a fluid using OpenCV.</li><li>› Used Python to perform data analysis on real word data to determine the dynamics of a complex non-newtonian fluid system.</li></ul> <p>OpenCV Python Computational Physics Computer Vision Rapid Prototyping</p>
December 2016 May 2019	<b>Digital Scholarship   Website designer, HAVERFORD COLLEGE, Pennsylvania</b> I worked on <a href="https://archivogam.haverford.edu/en/">https://archivogam.haverford.edu/en/</a> , a website designed to connect persons illegally detained and forcibly disappeared in Guatemala during the Civil War with friends and relatives. <ul style="list-style-type: none"><li>› Wrote the front and back end of Home and Images Section of Archivo Gam using django.</li><li>› Wrote various shell scripts to facilitate development, testing, and deployment.</li></ul> <p>Python Linux Shell Scripts Django git command line</p>

## EDUCATION

December 2021	<b>University of Pennsylvania   Mechatronics and Robotic Systems , (MASTERS OF SCIENCE IN ENGINEERING), Philly,PA</b>
January 2020	› Mechatronic and Robotics engineering master's student. <p>Robotics Mechatronics Controls Machine Learning Computer vision Electrical design Sensors</p>
December 2020 August 2016	<b>Haverford College  Physics , B.S, Haverford,PA</b> <ul style="list-style-type: none"><li>› Fluid dynamic research; Thesis : Touch Down of a Sphere in Viscoelastic Media</li></ul> <p>Physics Math Dynamics Mechanics Computational Physics Coding Problem Solving Experimentation</p>

**LEARNING INVERSE KINEMATICS**

 [Shaunfedrick.com/portfolio](http://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](http://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`