

## Education

### Stony Brook University

*Ph.D., Mechanical (Concentration: Design and Robotics, Minor: Applied Mathematics), GPA 3.95*

Stony Brook, NY

*Aug. 2015 – Present*

- **Relevant Coursework :** Robotics, Advanced Dynamics, Vibration and Control, Kinematic Analysis and Synthesis, Applied Stress Analysis, Product Design Optimization, Geometric Modeling, Analysis of Algorithms

## Experience

### Stony Brook University

*Research Assistant*

Stony Brook, NY

*May 2017 – Present*

- Developing a Computational Framework for Data-Driven Mechanism Design Innovation supported by \$450K [NSF grant](#).
- Created [MotionGen](#) a web-based mechanism design framework. Uses MEAN (MongoDB, Express.js, Angular.js, Node.js) stack to create a RESTful web service based on MVC architecture. iOS and Android app created using Apache Cordova framework.
- Path synthesis of mechanisms based on Fourier descriptor fitting using Nelder-Mead and Simulated Annealing optimization.
- Mixed motion and path mechanism synthesis using optimal non-uniform DFT and Singular Value Decomposition.
- Real-time simulation of planar and spherical mechanisms with prismatic and revolute joints using Newton-Raphson optimization.
- Synthesized path tracing mechanisms with optimum transmission angle using wavelet features in a neural network.
- Developing Spatial mechanisms synthesis techniques using Homotopy methods for type and dimensional synthesis.

*Teaching Assistant*

*Aug 2016 – Apr 2017*

- Developed [SnappyXO](#), a laser-cut design-driven robotics platform which enables designing mechanisms, structures, and robots.
- Advised 250+ undergraduates in MEC101-Freshman Design Innovation and MEC 102-Engineering Computing.

### Vivonics, Inc.

*Product Design Intern*

Stony Brook, NY

*Feb 2016 – Aug 2016*

- Developed PMT Monitor, a portable medical headset which detects head trauma by measuring visually evoked potential.
- Generated concepts for a mechanism which adjusts the interpupillary distance between the lenses. Focus was on manufacturability and robustness.

### Leviathan Energy

*Design Engineer*

Stony Brook, NY

*Feb 2016 – May 2016*

- Collaborating on propeller airfoil design under Strategic Partnership for Industrial Resurgence program by SUNY.
- In charge of part design using design software such as Solidworks and Autodesk Inventor and prototyping of designed parts by FDM based 3D printing techniques.

### Indian Institute of Information Technology

*Junior Research Fellow*

Jabalpur, India

*May 2014 – May 2015*

- Led a \$70k+ research project funded by the Science and Engineering Research Board titled “Development of Additive-Subtractive Integrated Rapid Prototyping System for Improved Part Quality”.
- Designed and Fabricated a Pellet based Screw Extrusion process to enable the use of CNC machines as hybrid 3D printers.
- Developed Toolpath Planning strategies to manufacture CAD models using Hybrid Manufacturing techniques.

## Relevant Projects

### Lane Detection for Autonomous Vehicles

*Python, Jupyter, OpenCV* [github.com/ssharma1991/autonomous-car-basic-lane-detection](https://github.com/ssharma1991/autonomous-car-basic-lane-detection)

Udacity

*May 2019 – Aug 2019*

- Created a robust image processing pipeline to detect a highway lane in an image, pre-recorded video, or live-feed from dashcam.
- Calculated the car's position within lane and lane's radius of curvature using perspective transform and polynomial fitting.

### Traffic Sign Classification

*Python, Jupyter, OpenCV, TensorFlow* [github.com/ssharma1991/autonomous-car-traffic-sign-classification](https://github.com/ssharma1991/autonomous-car-traffic-sign-classification)

Udacity

*May 2019 – Aug 2019*

- Created a LeNet inspired convolution neural network using TensorFlow to classify the [GTSRB](#) traffic sign dataset.
- Implemented data augmentation and image enhancement using OpenCV to achieve 94.8% accuracy on test dataset.

### Behavioral Cloning

*Python, Jupyter, Keras* [github.com/ssharma1991/autonomous-car-behavioral-cloning](https://github.com/ssharma1991/autonomous-car-behavioral-cloning)

Udacity

*May 2019 – Aug 2019*

- Created an end-to-end convolution neural network using Keras that predicts steering angles from dash-cam images.
- Used this model to autonomously steer a car around a virtual test track after neural network tuning and data augmentation.

### Sensor Fusion

*C++* [github.com/ssharma1991/autonomous-car-sensor-fusion](https://github.com/ssharma1991/autonomous-car-sensor-fusion)

Udacity

*May 2019 – Aug 2019*

- Processed LIDAR and RADAR data to estimate the position of a moving car with extended Kalman filter.

### Two Armed Robotic Manipulator

*Matlab*

MEC529 Robotics

*March 2016 – May 2016*

- Optimal motion planning in Dual Quaternion space to pick and place objects considering manipulator reachability.

## Interactive Manipulation of NURBS Surfaces

C++, OpenGL, Qt5

MEC572 Geometric Modelling

March 2016 – May 2016

- OpenGL based implementation in C++ for interactive manipulation of Non Uniform Rational B-Spline Surfaces.

## Fracture test analysis for compact tension specimen

Feb 2017 – May 2017

- Finite element analysis of a fracture specimen to predict and validate deformations at the crack tip using Abacus.

## Conceptual Design

Aug 2015 – May 2016

- Conceptual design of an Ergonomic Nutcracker and Stone Crusher.
- Formulation of product design specification and criteria and generation of the best possible product concept.

## Quality Improvement of Aircraft Wing Assembly

Aug 2015 – Nov 2015

- Identifying and correcting the root cause for high rejection rate of final assembly using Pareto Charts, Cause and Effect Diagrams, Control Charts and Histograms.

## Mold Design and Manufacturing

May 2012 – Nov 2012

- Designed and manufactured molds for irrigation industry products for Injection Molding Process.
- Flow Analysis results were used to optimize design and a Pricing Strategy was developed for industry.

## Technical Proficiency

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- **Languages :** Python, Javascript, C++, MATLAB, Mathematica
- **CAD softwares :** Solidworks, Autodesk Inventor, PTC Creo, CATIA, Ansys (CFD and Mechanical), Autodesk AutoCAD, Autodesk Moldflow, FeatureCAM, MSC-Adams, ZWCAD, Altair HyperMesh, Altair OptiStruct, Materialize Magics, Materialize Mimics, CNC G-M Code, Minitab
- **Tools & Technologies :** Keras, Tensorflow, OpenCV, HTML, CSS, Canvas, Node.js, Express.js, Redis, Apache Cordova, OpenGL, Jupyter, Anaconda

## Selected Publications

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- Sharma S., Purwar A., Ge Q.J.; **A Motion Synthesis Approach to Solving Alt-Burmester Problem by Exploiting Fourier Descriptor Relationship Between Path and Orientation.**, ASME J. Mechanisms Robotics; doi:10.1115/1.4042054
- Sharma S., Purwar A., Ge Q.J.; **An Optimal Parametrization Scheme for Path Generation Using Fourier Descriptors for Four-Bar Mechanism Synthesis.**, ASME J. Computing and Information Science in Engineering; doi:10.1115/1.4041566