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M.S. Mechanical Engineering
Arizona State University, Tempe, AZ

PORTFOLIO

ABOUT

I hold 6+ years of work experience in the field of Injection Moulding, Mechanical Design, Additive Manufacturing and Production Engineering. Through this portfolio, I present some important projects that I developed in the past. Currently, I am building expertise in Mechanical Design, Robotics and Thermal Engineering and would love to pursue a career in the same.

Diamond Age 3D, AZ-USA
Mechanical Design Engineer
Year 2023

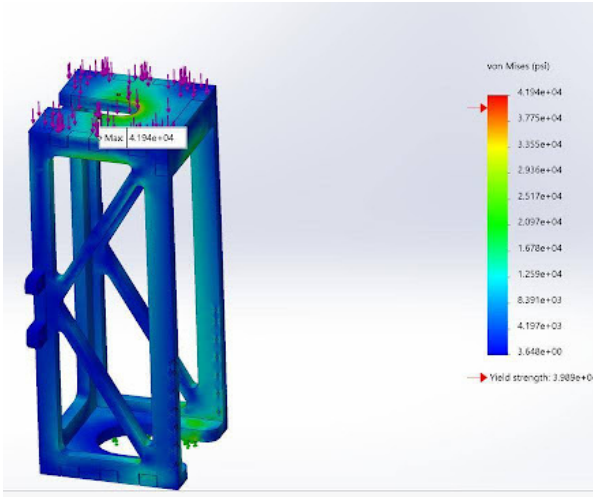
QUICK TIE TENSION TOOL DESIGN

Overview

We needed a reliable method of post-tensioning homes after 3D printing the walls, the current method was manual and time-consuming, requiring 8+ hours of tensioning and a minimum of 2 operators to complete this task. I was tasked with improving the design, making it faster, and less labour-intensive.

My contributions

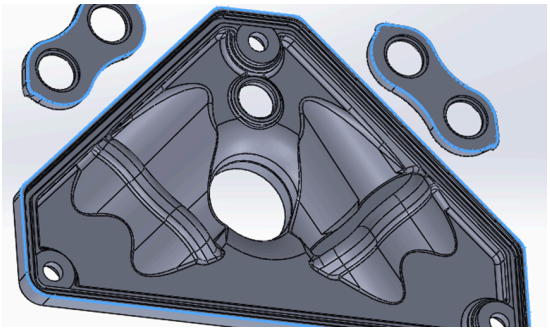
- Worked on the tool's core mechanism, a 4-jaw thread grabber that used pneumatic pressure to hold on to the quick tie rod.
- I calculated the required hydraulic pressure for the given pump and cylinder system based on the diameter of the quick tie and the housing standards.
- Made use of the overhead gantry to hold the mechanism and made it compliant in all DOFs to be able to locate the tool onto the quick tie easily.
- Designed a custom gearbox for the nut runner on the tool and modified a Milwaukee hand tool to act as the drive mechanism
- I redesigned the cage to make the mechanism from 6061-T6 Aluminium instead of plain carbon steel. This helped dramatically reduce the weight and was easily balanced on the gantry. The new cage design was analyzed on Solidworks simulation and satisfied the factor of safety requirements

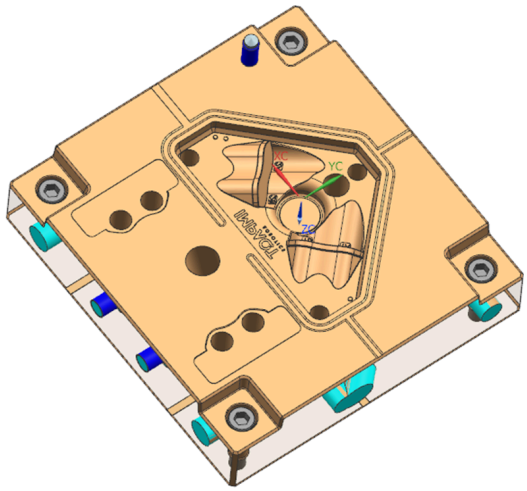


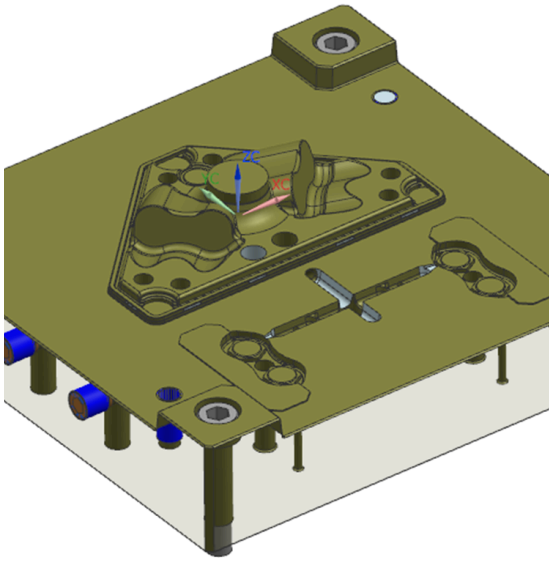
Results

The new tool was able to complete the tensioning process for an entire house in under 3 hours using only one operator

Tech Plaastic Industriee, India
Senior Engineer
Year 2022







TOOL DESIGN & MANUFACTURING

I worked with customers from initial drawings and suggested design improvements for feasibility and ease of moulding

Process Flow

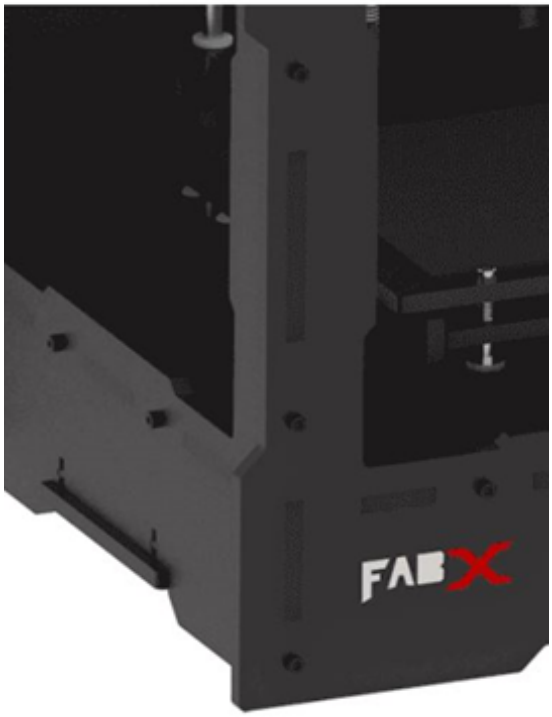
Alstrut India required robotic arm end effectors. They had a tight timeline of 4 weeks and a low-volume mould.

- I worked to create a DFM for the customer and explained the tool construction and steel used.
- We used P20 steel as it was for low volume and designed a submarine gate system to ensure part aesthetics were met to standard.
- I also conducted a measurability study and discussed critical dimensions with the customer
- After approval from the customer, we complete the tool drawing and send out machining drawings to vendors and to the in-house machining centre
- Post-machining we inspect the parts for dimensions, assemble the tool and conduct trials
- We inspect the parts for features and dimensions and generate a report known as the first article inspection report once we are satisfied with the dimensions.
- After customer approval, we create PPAP documents which relate to the complete process control for production, inspection, packaging and shipping. This is signed off by the customer and then full-scale production commences

3Ding-Redd Robotics, India
Design Engineer
Year 2018

DESIGN AND FABRICATION

3D PRINTER

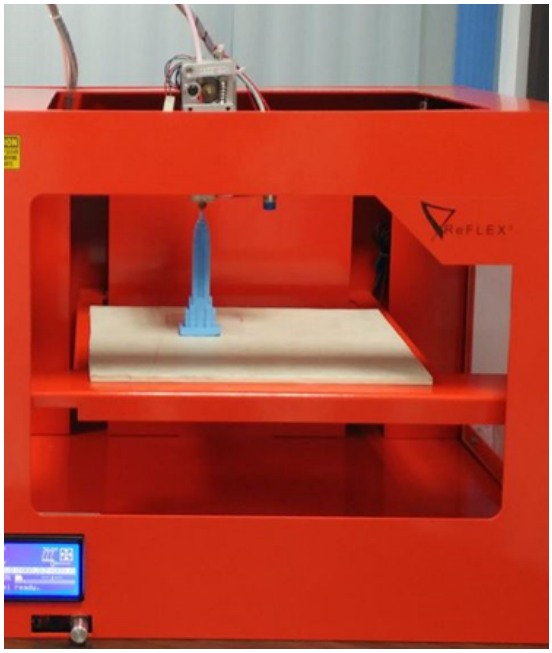


Overview

My main task as a Design engineer was to expand the product offerings, improve the frame design and cost efficiency of parts and also eliminate the issues with extruder blockage.

My contributions

- Designed a custom 3D printer using a core XY mechanism and tested different frame materials such as aluminium, plain carbon steel, MDF etc.
- Developed a custom direct drive mechanism
- Added new features such as filament detection, flexible build platforms and bed levelling sensors
- Designed and tested a variety of extruder heads and mechanisms for dual extrusion
- Tested frame designs for cost and functionality
- Created documentation and fixtures for the manufacturing and production teams
- Improved the reliability of machines and eliminated extruder failures with TPM approach



Outcome

- 3Ding created a wide range of products based on machine size and upgradable options
- New features helped improve revenue
- Eliminated extruder-related failures

Carborundum Universal, India
Engineer
Year 2016

CHANGE OVER ELIMINATION

Resin changeover

Disc changeover

Overview

Resin Changeover
The production line was being stopped at regular intervals to refill the resin tank from the mixing station. A total of 135 minutes was spent on refilling resin every day.

Disc Changeover
When the product disc size changed, each holder on the conveyor had to be replaced. Two sizes were used - 16 & and 32 inches.

My contributions

Resin Changeover
A parallel resin tank was installed at the production line to eliminate the production stoppage. I designed a series of valves to ensure that the changeover of tanks can happen smoothly

Disc Changeover
I worked on designing a simple rotatable mechanism that accommodate both sizes of discs and can be interchanged during machine operation

Outcome

- I was able to improve the overall equipment efficiency of the production line by 15%
- Stoppage losses were eliminated
- Was awarded the “Rising Star” for efficiency improvements

ASU Project
FALL 2022

THERMODYNAMICS OF HURRICANES

Overview

This project aimed to be able to look at images of Hurricanes and calculate its energy density and also real-time data across the globe and predict possible Hurricane occurrences.

Methodology

I used MATLAB for this project as it had several toolboxes such as the climatic toolbox. I collected images and real-time data from official websites and used these for my analysis.

I measured various parameters such as ocean temperature, barometric pressure, wind speeds and direction to make predictions

During the study of this project, I also looked into the key parameters on the dates of major hurricanes to check for positive correlation.

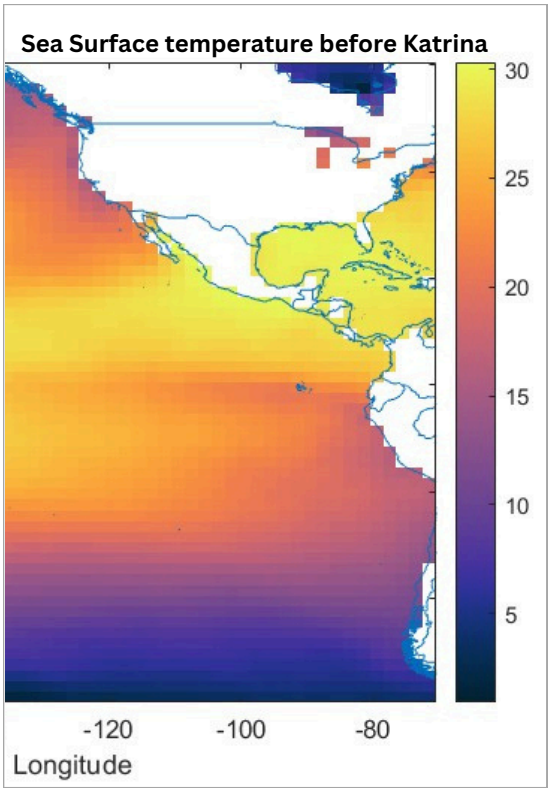
My analysis was in line with the data available online.

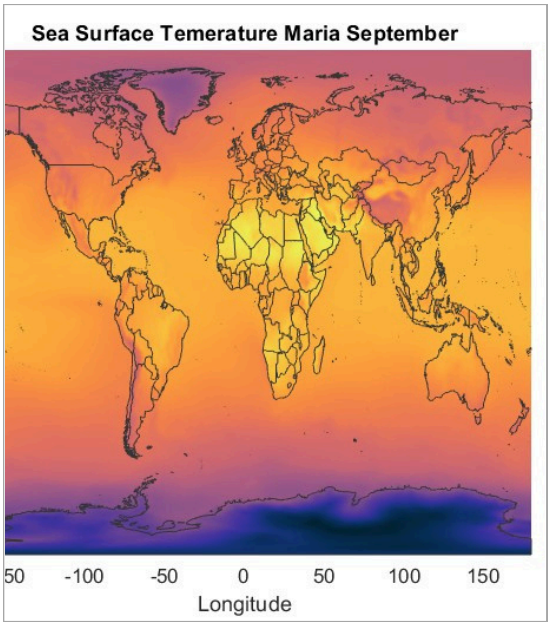
View my code:

https://github.com/hussainsail2002/Thermodynamics-of-Hurricanes-Matlab

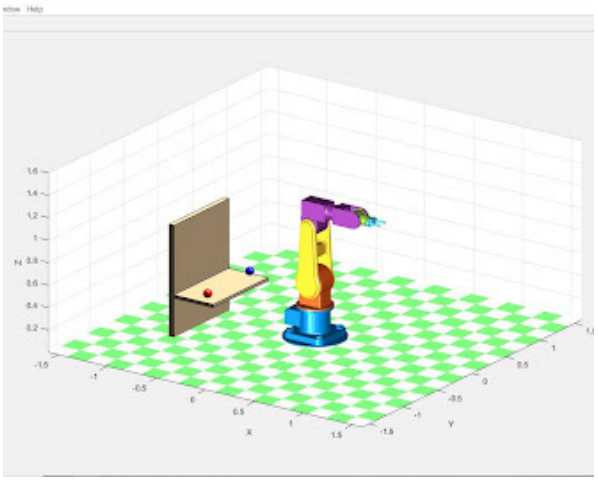
Outcome

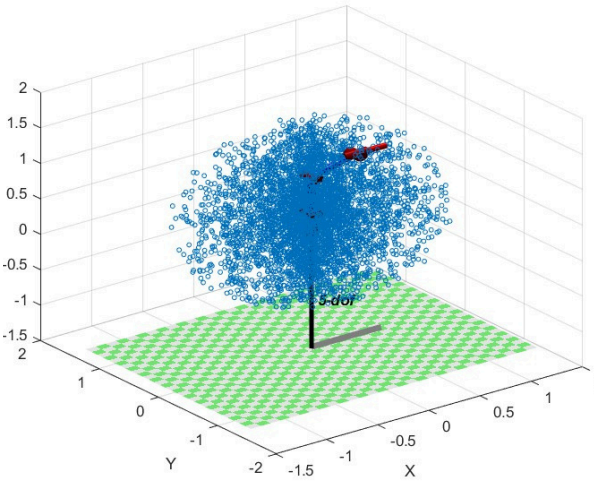
- I was able to come up with a set of functions that could reliable quantify the amount of energy in a hurricane.
- I was also able to predict possible occurances of Hurricanes based on sensory readings





ROBOT - 5 DOF ARM





Overview

In this project, I was tasked to design a 5 DOF robotic arm and perform a basic pick and place task.

My contributions

- Designed the geometry of the arm based on open-source examples
- Built the kinematics from the basic DH table and modelled the robotic arm in SolidWorks
- Used the Matlab robotics toolbox to code the trajectory motion
- Calculated the reachable work space of the robotic arm based on sampling method

View my code:

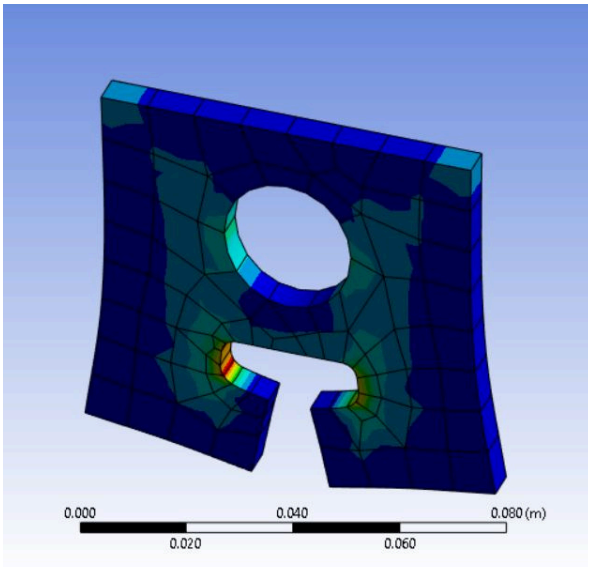
https://github.com/hussainsail2002/5-DOF-Robotic-arm---Trajectory

Outcome

- I Successfully simulated the pick-and-place task with an optimized trajectory
- I learnt how to use the robotics tool box and implemented forward and inverse kinematic algorithms

ASU Project
FALL 2023

DESIGN OPTIMIZATION IN ANSYS

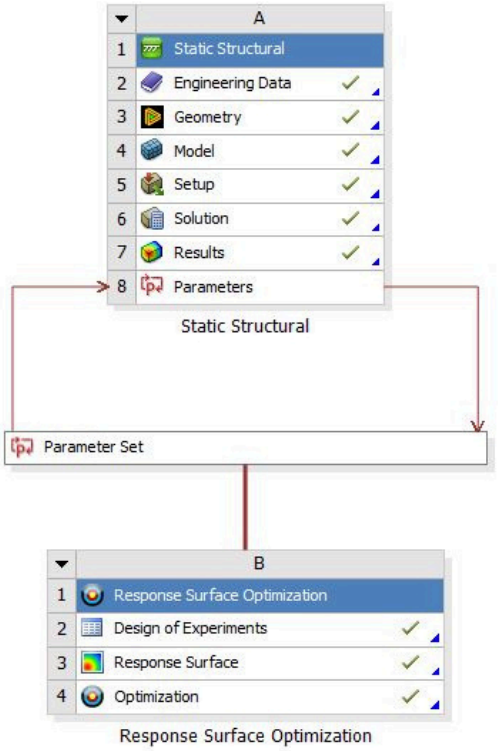


Overview

The objective of this project was to minimize the principal stress by varying the geometry and using DOE Methods for a specific loading case.

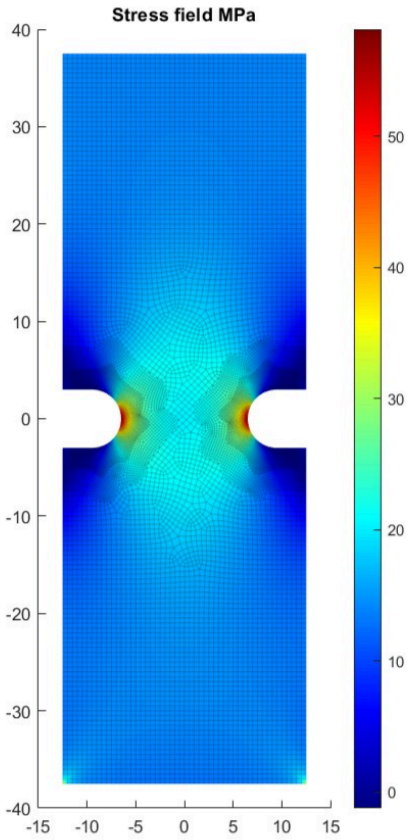
My contributions

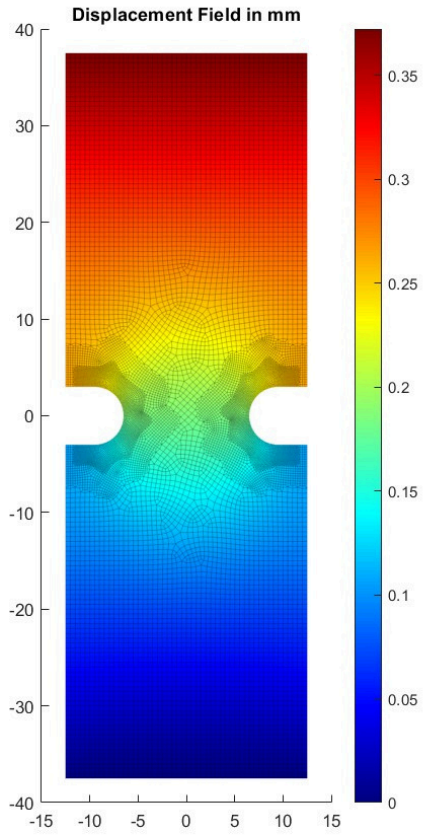
- Analyzed the key parameters that affect the stress and set them as variable parameters
- Used the DOE tools in Ansys to calculate principle stress at every unique combination of the parameters
- Plotted the sensitivity analysis to understand the parameters that have the greatest impact



Outcome

- Analyzed the key parameters that affect the principle stress and optimized them within their bounds





FINITE ELEMENT ANALYSIS IN MATLAB AND ABAQUS

Overview

In this project I worked on writing Matlab code to solve a simple structural problem and checked the outcome by modeling the same on Abaqus. The two solutions were also compared with hand calculations.

Methodology

- Created a 2D mesh with 8-node quadrilateral elements. The results were extrapolated for a 3D model
- Applied boundary conditions through the stiffness and force matrix
- Solved for displacements and calculated stress values at each node

View my code:

https://github.com/hussainsail2002/FEA-Analysis-Matlab

Outcome

- Results of stress and displacements were graphed using the patch and colormap command
- A comparison of the final result was made between Matlab, Abaqus and analytical calculations and results were found to be similar