SHAPE OPTIMIZATION OF ROBOTIC GRIPPER (GE BRACKET) USING FUSION 360

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Abstract—In engineering application a Flat bracket is any intermediate component for fixing one part to another, usually larger parts. The role of a bracket is to be an intermediate between the two and fix the one part to the other. Brackets vary widely in shape, but a prototypical Flat bracket is Flat shaped metal piece that attaches a shelf (smaller component) to another part (larger component). The shelf bracket is as effective as that of the architectural bracket. The objectives of the research is to optimize the shape of usual flat bracket and suggest the best shape at lowest cost with same loading conditions with help of Fusion..

Keywords—Robotic Gripper, Design Prototype, Stress Analysis, Fusion 360

1 INTRODUCTION

One key component of the configurability of the automation system is the robot gripper module. The gripper module is an actuator with jaws that grasps an object and allows the work piece to be picked up, transferred and placed by the robot. They are typically mounted at the end of a robot arm and at the point of contact with the work piece. Automation components such as robot arms and software are flexible enough to be programmed for a wide variety of tasks and therefore, can be reused to produce multiple variants of products. However, the gripper module can be very specific to one task and is often specifically chosen and outfitted with gripper finger tooling to help adapt.

Designing functional robot gripper fingers can be complex and sensitive. Moderate to advance engineering techniques and an iterative process is typically used to validate designs and arrive at an optimal solution. Some of the key concepts are outlined below to give a basic overview of considerations when designing gripping components

The most important task before design engineer is to maintain the working stresses within predetermined specific limits, in order to avoid the failure of a member. To improve the product quality, it is necessary to determine the stresses in various components.It is also necessary to know the stress distribution in order to predict the failure of component. Robotic Gripper is used to handling the different task so that Robotic Gripperbracket isresolving different stresses we are focusing on that analyzing through Fusion 360 software as well as optimizing of shape Robotic Gripper (GE bracket)

2 OBJECTIVES OF SHAPE OPTIMIZATION OF ROBOTIC GRIPPER (GE BRACKET) BY USING FUSION 360

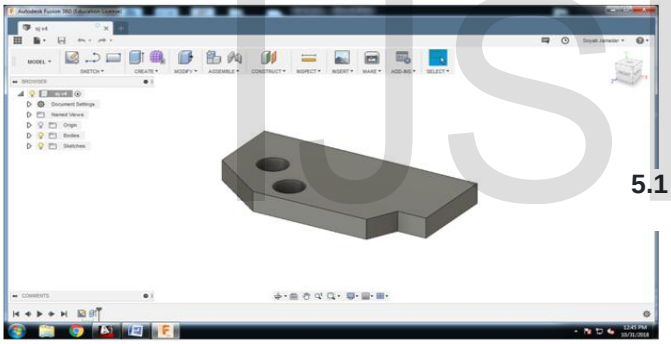
The objectives of the project include modelinganalysis, shape optimization of Robotic Gripper bracket using Fusion 360 software.

➢ **This project work divided in following way-**

- Modeled in Fusion 360 software
- Determine Stresses on Robotic Gripper bracket
- Determine maximum failure occur in the bracket.
- Shape optimization of Gripper bracket

That helps to reduce the cost of Robotic Gripperbracket.

3 MODELLED IN FUSION 360



4 STRESS ANALYSIS OF ROBOTIC GRIPPER (GE BRACKET)

➢ **In this project work stress analyses of Robotic Gripper (GE bracket)**

DESIGN PARAMETERS

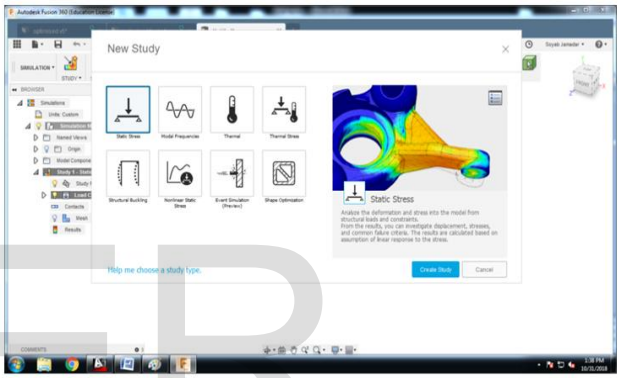
Length of flat bracket in mm.(FB) =150mm

Load applied on the flat bracket (W) =1500mm

Width of flat bracket in mm (FA) =80mm

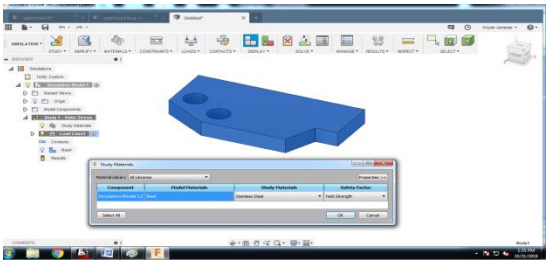
Young's Modulus	193000 MPa
Poisson's Ratio	0.3
Yield Strength	250 MPa
Ultimate Tensile Strength	540 MPa
Thermal Conductivity	0.0162 W/(mm C)
Specific Heat	477 J/Kg K

5 STATIC STRESS STUDY DONE THROUGH SIMULATION WORKSPACE IN FUSION 360.



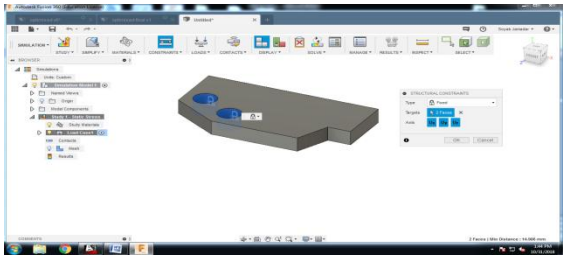
5.1 APPLY MATERIAL

Each Study can override materials from the original design. We can test multiple variants of material. Material dialog also offers options for Safety Factor for each component. For the Robotic Gripper (GE bracket)we use stainless steel material.



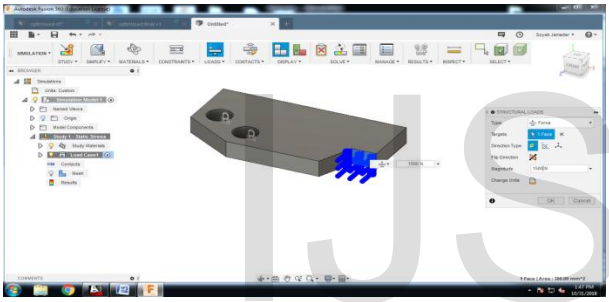
5.2 Add Constraint

Fixed Constraint is the easiest way to define how the design is connected with the rest of the technical system that is not part of Fusion model.



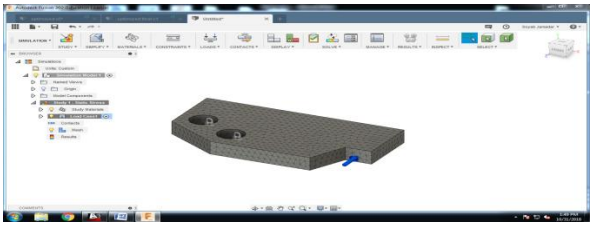
5.3 Add Load

Force is typical way to define how the design is loaded. Apply the design load on the component For e.g. 1500N



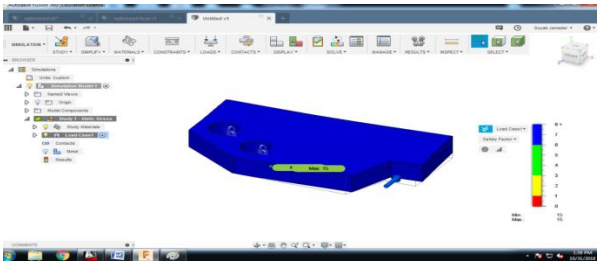
5.4 Apply Mesh

Select the suitable scale for mesh and then apply the mesh to the model drawing.



5.5 Solve and Analyze Results

Single click to Solve button calculates and shows the Results. Legend maps colors to the numerical values. Safety Factor is a good place to start analyzing feasibility of design

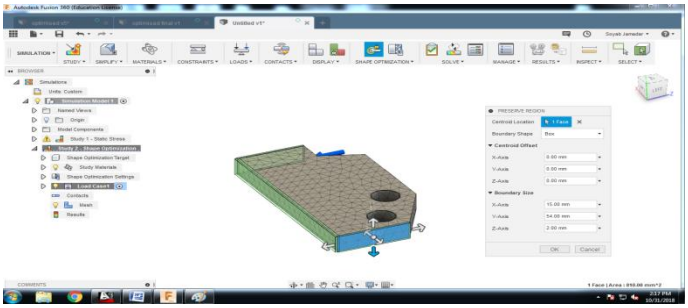


6.SHAPE OPTIMIZATION OF Robotic Gripper (GE bracket)

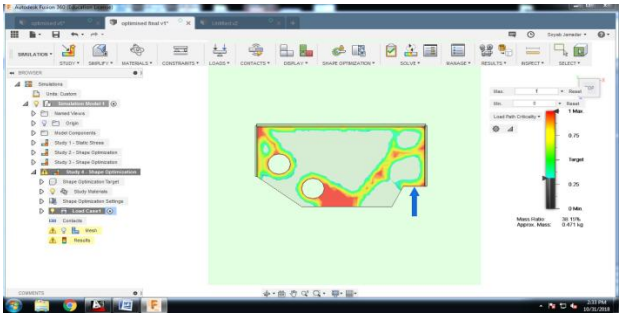
- It has always been the subject of interest and research work to find out most efficient method to minimize the fatigue failure and stress loss of any surface and any mechanism. For this research work the design modification and static structural analysis are starts, then still going on to optimize its shape so that loss will be minimum.
- In this project, a research has been done on the design modification of Gripper bracket and to optimize its shape and to reduce material.
- To improve the product quality, it is necessary to determine the minimum material required for components.

6.1. SHAPE OPTIMIZATION OF Robotic Gripper (GE bracket)

- Select the shape optimization study in simulation workspace in FUSION 360 Software
- Select the preserved surfaces for the flat bracket.



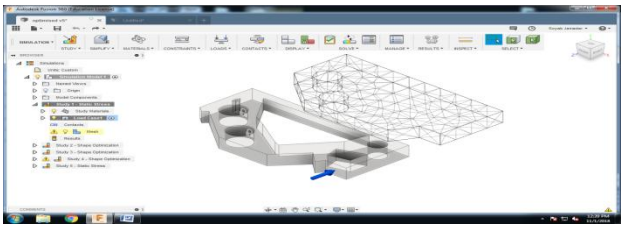
6.2 SOLVE THE STUDY



After optimization we get the optimized body. We should select the proper mass ratio and approx weight

6.3 PROMOTE THE OPTIMIZED BODY AND CONVERT IT INTO THE REGULAR DRAWING BY USING SKETCH TOOLS.

6.4 FINAL SHAPE OF ROBOTIC GRIPPER (GE BRACKET)



7.RESULTS

Von mises – 13.15 MPa = 1.34*10^6 Kg/m^2

1st principle- 11.23 MPa = 1.14*10^6 Kg/m^2

3rd principle- 0.6209MPa = 6.33*10^4 Kg/m^2

Total displacement = 0.007351 mm

Mass of flat bracket before optimization = 1.18 Kg

Mass of flat bracket after optimization = 0.471 Kg

8.BENEFITS OF SHAPE OPTIMIZATION

Reduced Weight:

Products designed using generative design can offer a considerable weight saving over that of traditionally designed products.

- **Maintained or improved performance:**

Whilst reducing weight, generative designed structures are optimized to suit the specific structural requirements of a design. This helps them meet strength and stiffness performance requirements whilst, at the same time, using the least amount of material to do so.

- **Reduce development time:**

Through the use of infinite computing, 1,000s of design variants can be investigated in the same time it might take to create one design using a more traditional approach.

- **Increased creativity:**

As a result of creating 1,000s of ideas, designers and engineers can quickly explore the suitability of forms they may not have otherwise imagined or created.

- **Customized product development:**

Through the use of generative design and additive manufacturing, complex geometry specifically designed and optimized to suit an individual need is much more accessible than eve

9.CONCLUSION

- For analyzing static stress the area is reduced by using optimization. It is observed that though the volume is reduce the maximum principal stresses at the corner of flat bracket

remains nearly constant and it is found to be equal to that of stresses in original model of flat bracket

- The weight optimized of Robotic Gripper (GE bracket) is low as compared to original flat bracket
- Also the material required for simulated of Robotic Gripper (GE bracket) is less than material used for original square bracket.

It can reduce the cost of Robotic Gripper (GE bracket)

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