A Case Study of Hand Gripper And Its Optimization Using Finite Element Analysis

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***Abstract*— The designed hand gripper mechanism in this work is a two jaw actuated gripper which is different from the conventional cam and follower gripper in the way that controlled movement of the jaws is done with the help of human hand and muscular power. In this case study we have focused the attention on the dimensional of the mechanisms in two-finger grippers that we have named as gripping mechanisms to emphasize on their basic gripping purpose. The design problem has been approached for the basic characteristics of gripping mechanisms. A case of study has been reported as a digital prototype to show the soundness of the proposed optimization procedure by using finite element analysis to computational and practical results.**

Key words: Digital Prototype, FEA, Ansys 17, Stress & strength, Optimization

I. Introduction

A. *Introduction*

Gripper is the effector of a mechanism. In this sense, it is akin to a human hand which allows one to pick and place any given object. Grippers are used in areas which involve hazardous tasks such as space exploration, high-temperature welding, handling radioactive materials, defusing bombs, mines and exploring shipwrecks, to name a few. Moreover, grippers are also useful in areas that involve tasks which are complex in nature such as the fabrication of micro-electronic structures, surgery, and so forth. An extensive survey on problems arising from the building, planning, designing, and controlling operations In this high-tech era, all high-industry products are becoming more sophisticated and more It is small and easy to carry. ? In recent years, research on topology optimization of compliant mechanisms has been straightforward the focus of attention. Designing a compliant machine due to topology optimization.

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II. HAND OPERATED GRIPPER AND ITS DESIGN

2.1 *Introduction*

A machine tool grippers is a device on a machine tool for clamping work pieces and guiding tools. Refers to a grippers specifically designed for a certain process of a work piece. The utility model has the advantages of compact structure, quick operation, convenient and labor saving, can ensure high processing precision and production efficiency, but has a long design cycle and high manufacturing cost. When the product changes, the grippers will be scrapped due to the inability to reuse. Only suitable for production with fixed products and large batch sizes.

Therefore the following points should be considered before the gripper is designed.

- Weight
- Rigidity
- Nature of material
- Characteristics of the lightweight arm and the maximum transportable load.
- Characteristics of the object which include.

The design as a whole is well thought out and provides high reliability, but it is rather complicated. Similar constructions of standard tongs are usually found in having equally well worked out other mechanisms. Specific are the features of the hydraulic gripper, which has a lifting capacity of 5 kg. The mechanism uses a pinion gear and parallel-hinged hinge mechanisms. Disclosure range.

2.2 The Basic Principle of Gripper Design.

1. Satisfy the stability and reliability of work piece positioning during use.
2. There is enough load or clamping force to ensure the processing of work piece on the gripper.To meet the simple and fast operating in the gripping process.
3. The vulnerable parts must be a structure that can be quickly replaced.
4. To meet the reliability of the gripper in the adjustment or replacement process.
5. Avoid structural complexity and cost as much as possible.

III. METHODOLOGY

1. Introduction

In order to analyse the wiring characteristics of the wiring having the constrained base end and the end of the connector constrained to the connector base by FEM, the screen of the display unit utilizes CAD data formed for designing the three-dimensional wiring shape and is used for inputting The condition setting screen for setting a part of the analysis condition not included in the CAD data among the wiring characteristics, the shape, the constraint position, and the constraint direction is operated, and the wiring virtual three-dimensional shape image including the connector is displayed. The position on the moving destination of the connector specified on the virtual three-dimensional shape image is recognized as the coordinate value of the constraint position. The shape of the wiring harness and the reaction when clamping the connector are analyzed by FEM based on the analysis conditions contained in the CAD data, the analysis conditions set on the condition setting screen, and the analysis conditions required to evaluate the constraint position specified by the coordinate values. . Basically we use to do tiredness testing out for following factors:

- Desired product life.
- Optimization of shape and size.
- Optimization of material consumption.

3.1 Capture designs

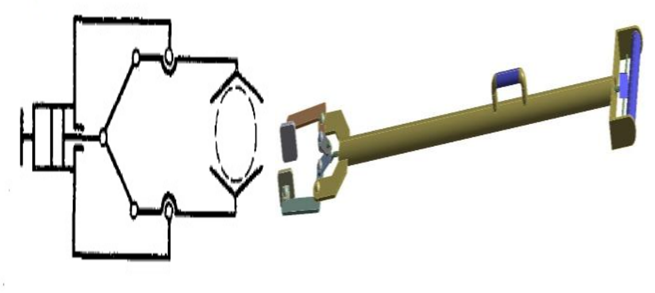


Fig.3.1 Mechanism and Design of Selection Model.

3.3 COMPONENTS USED AND CONNECTIONS

3.3.1 *Drawing Detail of Hand Operating Gripper Coupling:*

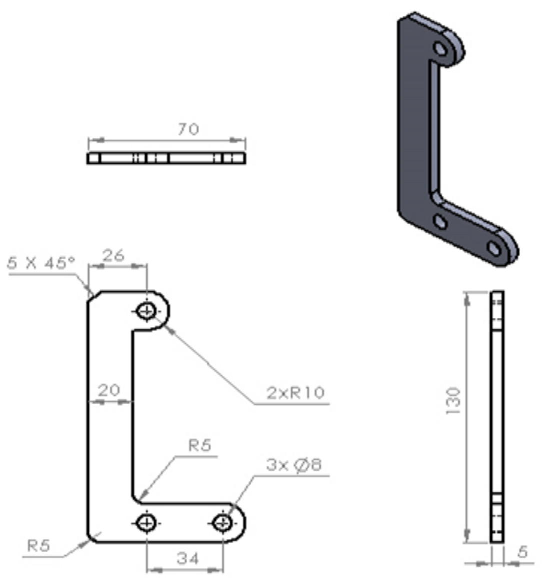


Figure 3.2:Drawing Detailing view of Hand Operating GripperCoupling Plat.

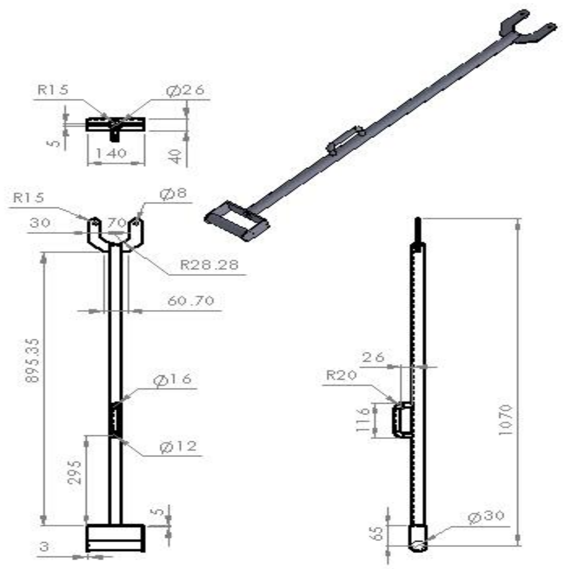


Fig.3.3 Main body of Operating Gripper Model.

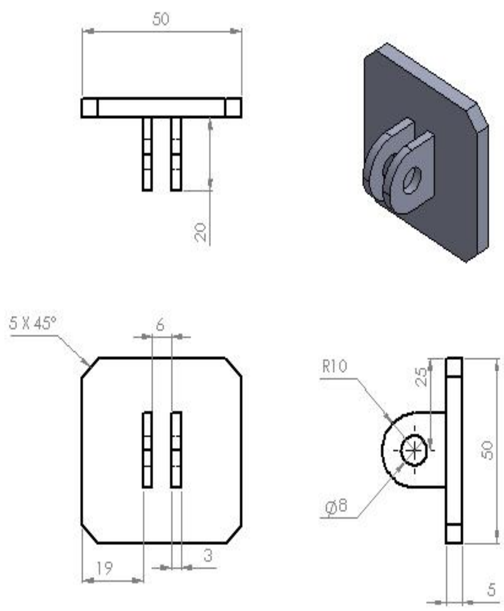


Fig.3.4 Gripper Holder contacting Plat.

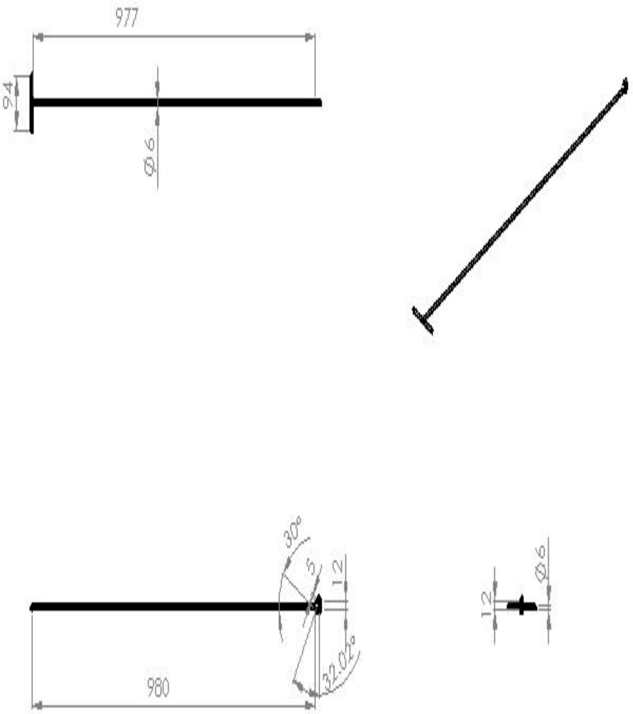
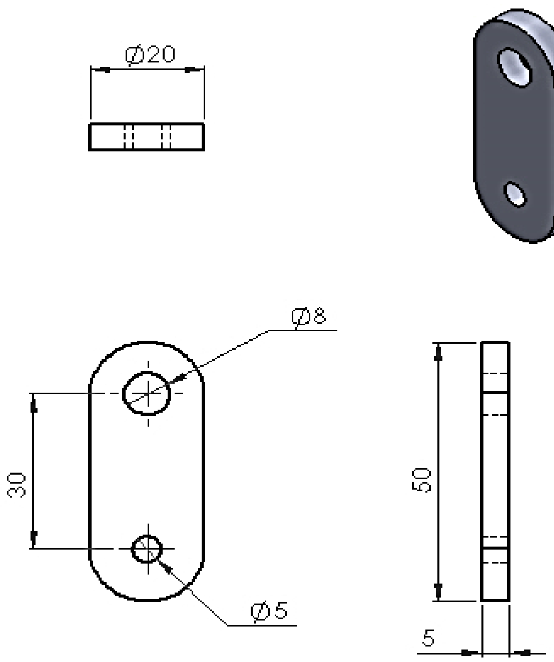


Fig.3.5 Connecting Rod of Jaw Bar



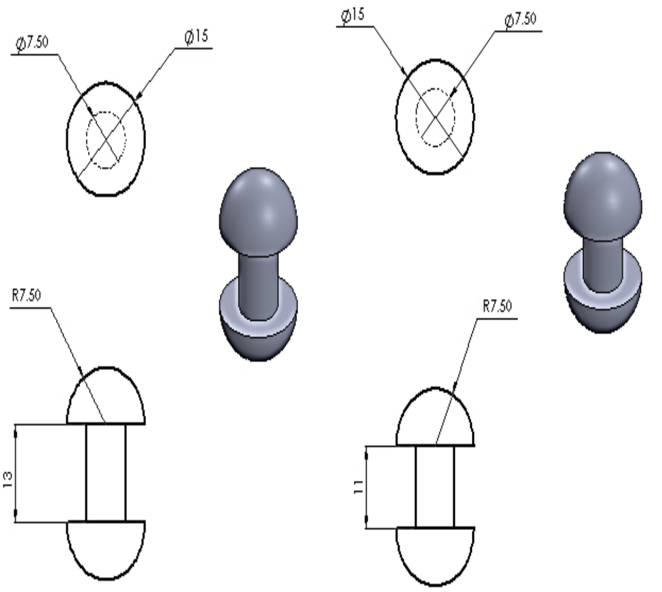


Fig.3.6 Connecting Richet Link and Joint Revit.

VI. RESULT ANALYSIS AND DISCUSSION

The gripper, and the materials were created in the CAD software, the step next is to simulate in virtual mounting the wall with the gripper. For this, the already existing macros for the current gripper were taken again because the Operating principle is similar to that of the gripper we designed. The goal of the overall project is ultimately to be able to design its building using the software Design work, to export it directly into the CAD software and that the Hand using the gripper automatically assembles the wall. As part of our end of study project, we set ourselves the goal of drawing a wall in Design work, importing it in CAD and simulate its editing using the gripper. The Design work to CAD export is done using the Design work element module in creating a wall and a support.

4.1 MECHANICAL PROPERTY OF COMPONENT:

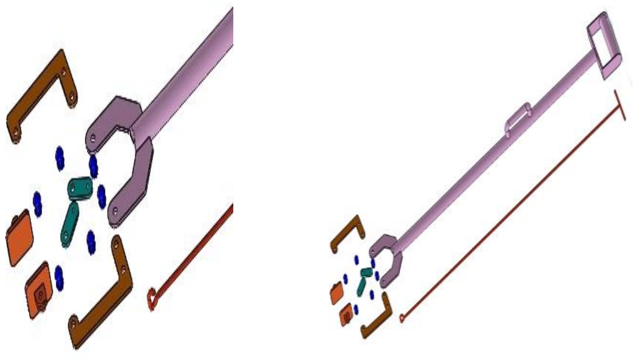


Fig. 4.1 Explode View of Assemble model.

4.2 WORKSPACES HOLDING VIEW AS ITS WORKS

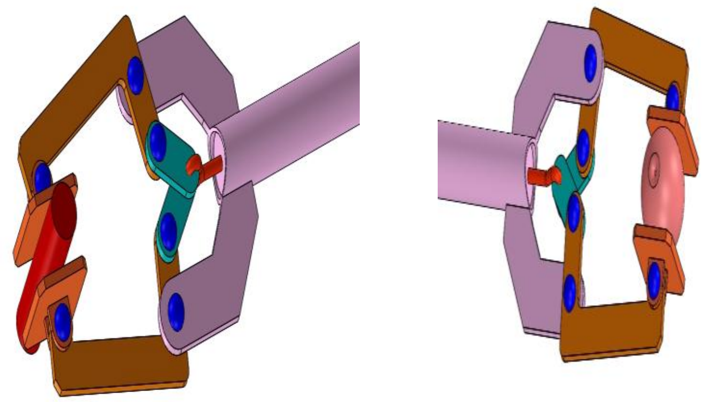


Figure 4.3:workspaces holding view as its works.

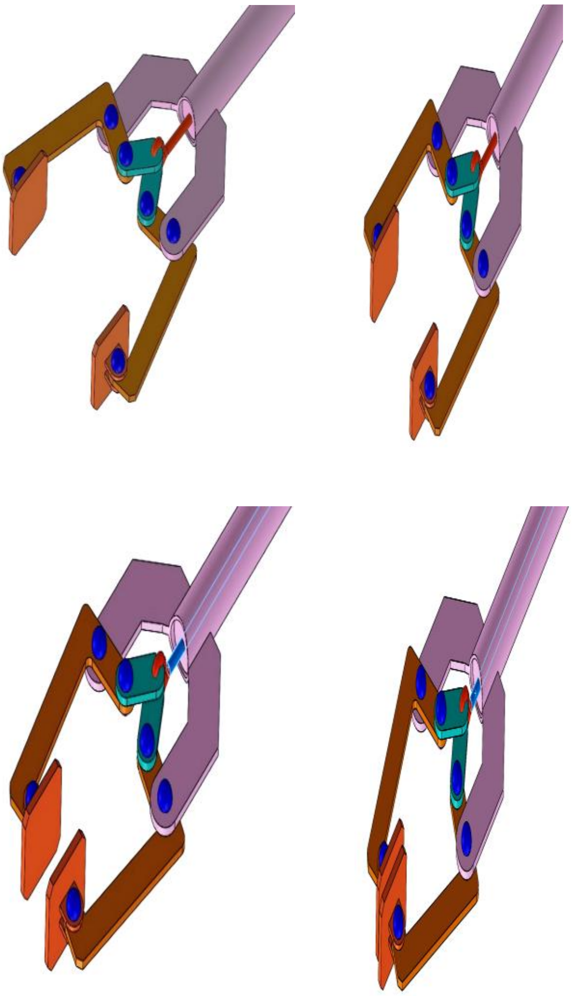


Fig.4.2 Different operating condition and Opening Gripper jaw Condition.

4.3 RESULT OF OPERATING CONDITION

4.3.1 Mechanical property of component for Aluminum Alloy Material:

- Aluminum Alloy

  Young’s modulus = 71 GPa

  Poisson’s ratio = 0.33

  Tensile yield strength = 280 MPa

  Compressive yield strength = 280 MPa

  Ultimate tensile strength = 310 MPa

4.3.2 Stress Calculation

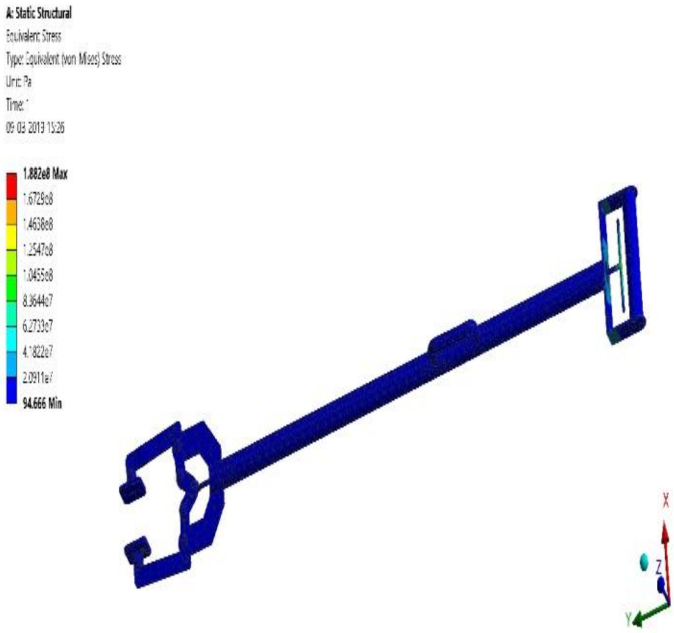


Fig.5.5Stress Calculation for design evaluation.

V. CONCLUSION

This study proposes a reliability-based compliant mechanism geometry new method for linear topology optimization design. Deployment and delivery processes for handling tasks of limp materials make high demands on the used Gripping technique and knowledge about the interpretation based on environmental technology Influences. The contribution is intended to assist the user the effective selection of available gripping systems support. The different possibilities as well as innovative approaches presented. Geometric nonlinear structural response Geometric nonlinear topology optimization mathematical model. Objective letter of the compliant organization the minimum flexibility and the maximum geometric gain are used to satisfy the mechanism's Degree and flexibility requirements. The electro adhesive principle has an effect the low holding forces disadvantageous. There by must always be the size of the effective area in relation to the weight of the blank part what the part flexibility strong limits. Structuring of the material surface reduce the adhesion area and will consider the geometry and the magnitude of the applied load. Deterministic reliability index as probability constraint, reliability analysis calculate with a reliability method. Target function sensitivity analysis with the solution technique.

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