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"DESIGN & ANALYSIS OF SCISSOR LIFT FOR BIKE SERVICING BY USING COMPUTATIONAL TESTING"

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ABSTRACT

This project is mainly focused on the design as well as analysis of hydraulic scissor lift when it is extended and contracted. A The deformation induced for four materials likes Carbon fiber , Steel, Magnesium Alloy and Al Alloy are respectively 1.89 mm , 4.80 mm, 21.3 mm and 13.5 mm So here at carbon fiber material found out less deformation value . The equivalent stress induced for four materials likes Carbon fiber , Steel, Magnesium Alloy and Al Alloy is almost same i.e. 168.2 Mpa, 180.59 Mpa, 178.2 Mpa 179.2 MPa here at carbon fiber material found out less stresses value. Hence the design is safe based on strength. On optimization it is clear that Carbon fiber material lift shows good results as compared to other two three material lift, hence Structure Carbon fiber material should be used for manufacturing scissor lift.

Key Words: *Carbon fiber, Steel, Magnesium Alloy Al Alloy, Stress, Deformation.*

I. INTRODUCTION

Scissor lifts are typical one of the vertical lifting equipment portable elevating work platforms . Scissors lift can be used indoor or outdoor with a considerable extensive space Their primary function is to elevate workers, tools, and materials to a desired working height, while allowing the operator to control the movement and position of the lift. Compared with conventional methods of lifting, scissor lift greatly reduces the psychological stress and physical demands on a worker at elevated height. Therefore, if a scissor lift is properly designed, manufactured, maintained, and appropriately used, it can increase not only the workers' productivity but also their safety. For these reasons, scissor lifts with different capacities and elevating heights are increasingly used at many workplaces. A scissor lift is a portable, easily extended and compressed, safe operating machine used for transportation of medium sized components to its expected position. A scissor lift is machine which moves in vertical direction using criss-cross 'X' pattern scissor arms. The required elevation of the lift is achieved based on the number of criss-cross 'X' pattern scissor arms attached. The scissor lift mechanism is based on linked arms in a criss-cross 'X' pattern which can be folded and extended in exact direction similar to a pantograph. The upward motion is achieved by the application of pressure to the outside of the lowest set of supports, elongating the crossing pattern, and propelling the work platform vertically upwards. The platform may also have an extending 'bridge' to allow closer access to the work area.

1.1 Types of Scissor lift

The scissor lifts can be classified as follows:

- Hydraulic lifts
- Pneumatic lifts
- Mechanical lifts

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II. Methodology

Deflection in scissors lifts can be defined as the change in elevation of all parts to the original size of entire assembly i.e from the floor to the top of platform deck, whenever loads are applied to or removed from the lift. Each component within the scissors lift has the potential to store or release energy when loaded and unloaded. Deflection takes place in all parts of scissor lift i.e Scissors Legs, Platform Structure, Base Frame, Pinned Joints**.** To reduce stresses and deflection in scissor lift the load should transfer equally between the two scissors arm pair. Base frames should be attached to the surface on which they are mounted.

2.1 Material Selection

Material selection plays a very important role in machine design. Three metals are considered for the analysis of scissor lift is Carbon fiber structural steel and Aluminum Alloy.

2.2 Structure Steel Mechanical properties

Table- 1 Structure Steel Mechanical properties

Material Field Variable	Value	Units
Density	7850	Kg/m3
Young's modulus	2E+05	Mpa
Poisson Ratio	0.30	
Shear modulus	76923	Mpa
Bulk Modulus	1.6667E +05	Mpa
Tensile Yield Strength	250	Mpa
Compressive Yield Strength	250	Mpa
Tensile Ultimate Strength	460	Mpa
Compressive Ultimate Strength	0	Mpa

2.3 Aluminium Alloy Properties Al (6061)

Table- 2 Aluminium Alloy Properties Al (6061)

Density	2770	Kg/m^3
Young's modulus	2.3E+05	Mpa
Poisson Ratio	0.33	
Shear modulus	26692	Mpa
Bulk Modulus	69608	Mpa
Tensile Yield Strength	280	Mpa
Compressive Yield Strength	280	Mpa
Density	2770	Kg/m^3
Young's modulus	2.3E+05	Mpa
Poisson Ratio	0.33	

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2.4 Magnesium Alloy Mechanical properties

Table- 3 Magnesium Alloy Mechanical properties

Density	1800	Kg/m^3
Young's modulus	45000	Mpa
Poisson Ratio	0.35	
Shear modulus	30	Mpa
Bulk Modulus	5e10	Pa
Tensile Yield Strength	193	Mpa
Compressive Yield Strength	193	Mpa
Tensile Ultimate Strength	255	Mpa

2.4 Carbon Fiber Mechanical properties

Table- 4 Carbon Fiber Mechanical properties

Density	1880	Kg/m^3
Young's modulus	127000	Mpa
Poisson Ratio	0.33	
Shear modulus	30	Mpa
Bulk Modulus		Mpa
Tensile Yield Strength	4137	Mpa
Compressive Yield Strength	2500	Mpa
Tensile Ultimate Strength	5980	Mpa

III. FINITE ELEMENT METHOD

By using solid works, modeling of scissor lift was done and then it was imported to Ansys17.0 for the analysis of scissor lift. The goal of meshing in ANSYS Workbench is to provide robust, easy to use meshing tools that will simplify the mesh generation process. In this hydraulic scissor lift automation meshing is applied and complete analysis of scissor lift was done.

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IV. MODELING

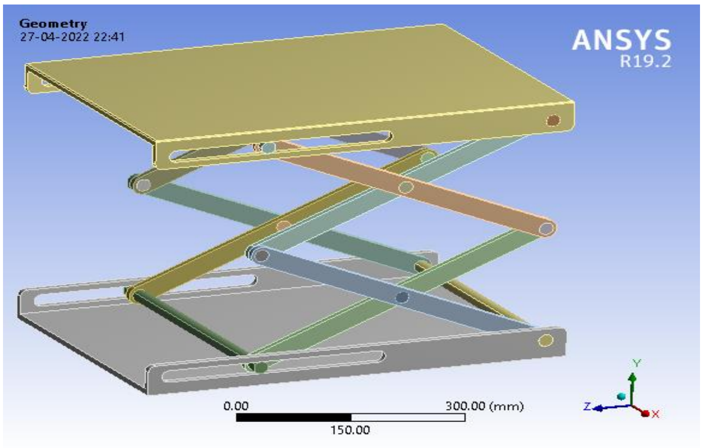

Fig 4.1 Carbon material scissor lift

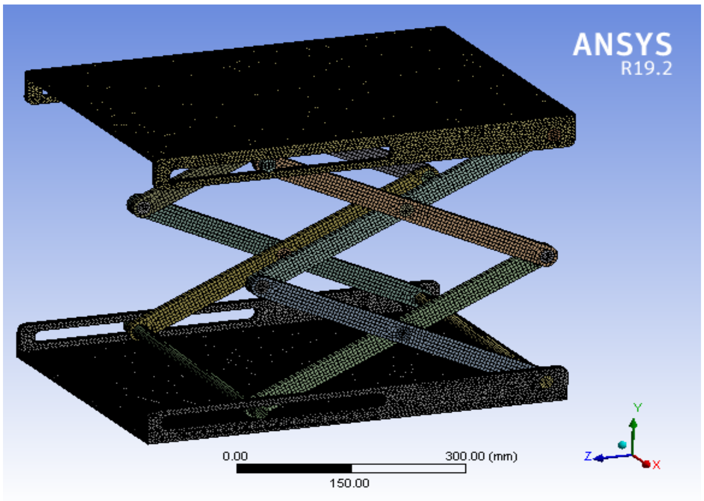

Fig 4.2 Carbon material scissor lift meshing

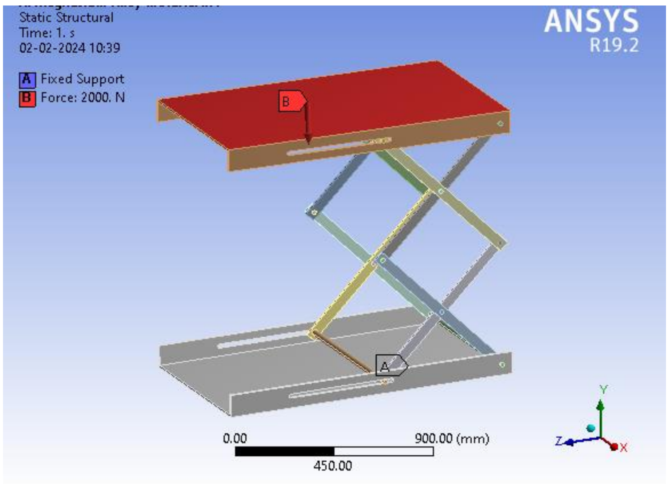

Fig 4.5 E-Glass material scissor lift overall boundary condition 2000N load applied

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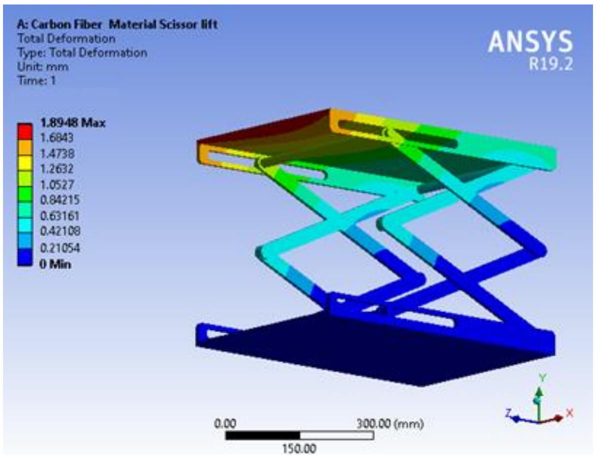

Fig. 4.11 Carbon Fiber material scissor lift deformation results

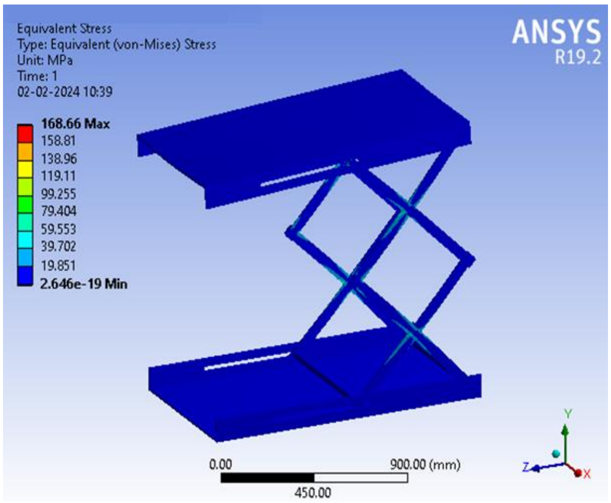

Fig. 4.12 Carbon Fiber material scissor lift Stesses results

V. RESULT & DISCUSSION

On the basis of computational testing FEM method results find out Hence based on rigidity the design is safe, The deformation induced for four materials likes Carbon fiber , Steel, Magnesium Alloy and Al Alloy are respectively 1.89 mm , 4.80 mm, 21.3 mm and 13.5 mm So here at carbon fiber material found out less deformation value . The equivalent stress induced for four materials likes Carbon fiber , Steel, Magnesium Alloy and Al Alloy is almost same i.e. 168.2 Mpa, 180.59 Mpa, 178.2 Mpa 179.2 MPa here at carbon fiber material found out less stresses value. Hence the design is safe based on strength. On optimization it is clear that Carbon fiber material lift shows good results as compared to other two three material lift, hence Structure Carbon fiber material should be used for manufacturing scissor lift.

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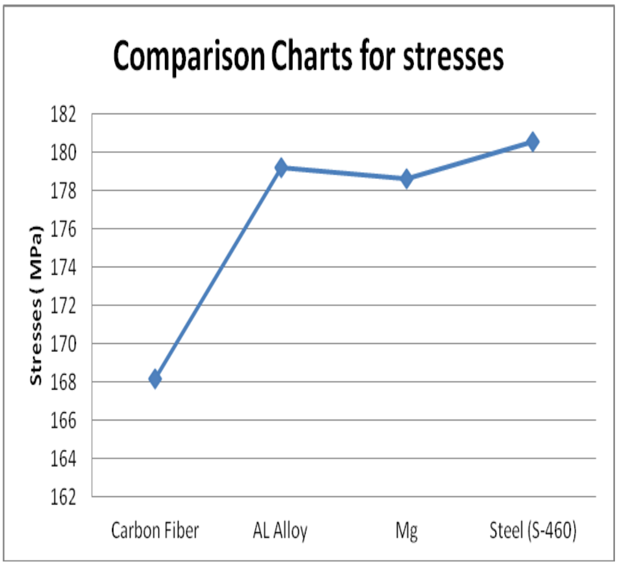

Fig.5.1 Comparison Charts for stresses

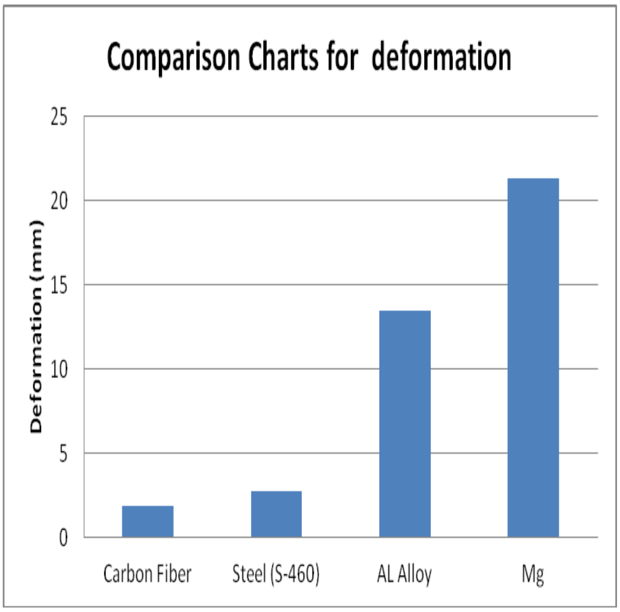

Fig.5.2 Comparison Charts for deformation

VI. Conclusion

The design and fabrication of a movable work platform lifted by a hydraulic cylinder were completed in accordance with the design specifications. The hydraulic cylinder that drives the movable work platform is powered by a motor. If an appropriate high capacity hydraulic cylinder is employed, the scissor lift can also be designed for high load. The hydraulic scissor lift is easy to operate and requires little maintenance. It is also capable of lifting bigger loads. This device's biggest drawback is its expensive initial cost, although it has a low operational cost. To provide high strength, the shearing tool should be heat treated. The savings generated by using this device will allow it to pay for itself in a short period of time. It can be a useful tool in any engineering field that deals with rusty or unusable metals.

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