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DESIGN AND ANALYSIS OF SCISSOR LIFITING MECHANISM

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Abstract: - *lifting mechanisms are becoming the vital equipment in the case of material handling in the industries. The material handling should be safe and it must be convenient for the movement inside the plant. In the current project a customized scissor lifting mechanism is being designed for lifting the three tone load. The entire mechanism is designed using the CAD package. Simulations of the 2-DOF planar translational mechanisms and the docking procedures were carried out. Finally the structural analysis is carried out for the structural strength of the links.*

Key Words: Scissor lift, material handling, planar translations

1. INTRODUCTION

Mobile elevating work platform (MEWP) is a mechanical gadget used to give impermanent access to individuals or gear to unavailable territories, for the most part at stature. There are particular kinds of automated access platforms and the individual sorts may likewise be known as a "careful selector" or a "scissor lift". The scissor lifts can be arranged by vitality utilized as water driven, pneumatic or mechanical. Every one of these onents has its upsides and downsides, which are considered and adjusted by its application in different businesses. Scissor lift configuration is favored over other hard work gadgets accessible in the market in view of its ergonomics. The casing is tough and sufficient with an expansion in structural strength.

1.1 Working Principle

This mechanism can be traveled through three different systems. By and large, the most as often as possible utilized kind of scissor lifts is gasoline or electrically controlled. Power or gasoline from an immediate outlet or battery is utilized to control the whole scissor lift. Electrically controlled scissor lifts are ideally utilized in spots where combustible materials and items are denied. Zones that have an excessive number of vapor, for example, burning regions and assembling destinations should keep away from gasoline or diesel fueled lift. Both gasoline and electrical scissor lifts are ordinarily utilized outside and are less inclined to be utilized in stocking different materials and products. This sort of lifting gear is equipped for achieving 10 to 18 meters over the ground. Another variety is the hydraulic lift. The hydraulic lift is controlled by fluid that is saved in the gear's tubing. This works when pressurized hydraulic fluid is siphoned in a ceaseless descending and upward movement inside the tubing. Then again, changes on the temperature may cause breakdowns on the lift. Temperature vacillations may perhaps cause consistency of the hydraulic fluid that will result to issues in the lift's component. The other kind of lifting gear uses air pressure to move the stage all over and is called pneumatic lift. It is natural cordial and exceptionally effective to utilize. Pneumatic lift uses compacted air.

1.2 Types of Scissor Lifts for Warehouses

Scissor lifts are an extraordinary assistance to distribution center operations. They give a protected working zone to those expecting to perform certain occupations and exercises at high areas. For instance, circuit testers can securely and comfortably work at electrical posts and wires. Basic designers can perform more thorough reviews of regions situated at raised positions. There are numerous other uses of scissor forklifts and a wide range of sorts. How about we investigate the kinds of scissor lifts that are utilized in distribution centers.

1.3 Major Components in Scissor Lift

Hydraulic scissor lift tables are contained five major parts

1. Platform – This is the highest point of the lift table where lifted item sits. It tends to be provided in an assortment of sizes.
2. Base – This is the base of the structure that lays on the floor. It contains the track the scissor legs travel in. 3. Scissor legs – These are the vertical individuals that enable the platform to change rise.
4. Hydraulic cylinder – The most widely recognized mechanical scissors lifts are activated by one, two, or three single-acting hydraulic cylinders. These enable the lift table to lift and lower.
5. Motor or Power Source – Most hydraulic scissor lifts are powered by either an electric or air motor.

1.4 Material choice

A proper material for these reasons for existing is auxiliary steel, all the more decisively the S355 steel.The second essential component of a design is the chamber. From the specialized perspective, it goes about as a bar with stuck closures. It is exposed to guide compressive force which prompts bending and locking load in the bar. Likewise, there exists the inside pressure of the fluid, which causes circumferential and longitudinal stresses all around the divider thickness. Along these lines the barrel must have such properties as quality, durability, malleability and hardness. A fitting material is mellow steel. There are additionally such segments as top plates and base plates. The top plates take the load brought about by a weight of lifting merchandise. The principle required property here is quality and the chosen material is gentle steel. The base plates are exposed to the heaviness of the load and scissors instrument itself– chamber and legs, consequently, hardness and firmness are required. Mellow steel is fitting

1.5 Grouping of lifting stages

To begin something new it is expected to take a gander at something that as of now exists. On the design lifts can be partitioned into the accompanying fundamental sorts: perpetual and compact. The perpetual lifts are: scissor raise stages, track lifting stage, propelling and unloading stages (Sinolifter.com 2011). A model is on Figure underneath.

1.6 Launching and unloading platform

The convenient lifts separated into: a few versatile lifting stage, two or three tractor-lift stages, improved vehicle lifting stage,

AC-DC double utilize working out with a stage, self-hoisting platform, wrench type raise stage, foldable arm lift stage, bundles chamber lift stage, lightweight aluminum lift stage, working out with range from 1-30 m. exhibit.

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2. INTRODUTION OF SOLIDWORKS

Strong works is a 3d strong displaying pack which empowers customers to develop full strong models in a copied circumstance for both structure and examination. In strong works; you sketch considerations and examination with different plans to make 3d models. Strong works is used by understudies, planners, engineers, and various specialists to convey direct and complex parts, gatherings, and representations. Structuring in a demonstrating pack, for instance, strong works is profitable since it saves time, exertion, and money that would by one way or another or another be spent prototyping the plan.

2.1 Solid Works Components - Parts

Before we begin looking at the software, it is important to understand the different components that make up a solid works model.

Part:

- The first and most basic element of a solid works model is a part.
- Parts consist of primitive geometry and feature such as extrudes, revolutions, lofts, sweeps, etc.
- Parts will be the building blocks for all of the models that you will create

Assembly:

- The second component is the assembly. Assemblies are collections of parts which are assembled in a particular fashion using mates (constraints).
- Any complex model will usually consist of one, or many assemblies.

Drawing:

- The third and final component in solid works is the drawing.
- A drawing is the typical way to represent a 3d model such that any engineer (or manufacturer) can recreate your part.
- Drawings are important because they provide a standard way of sharing your design.

Solid Works – Let's Begin

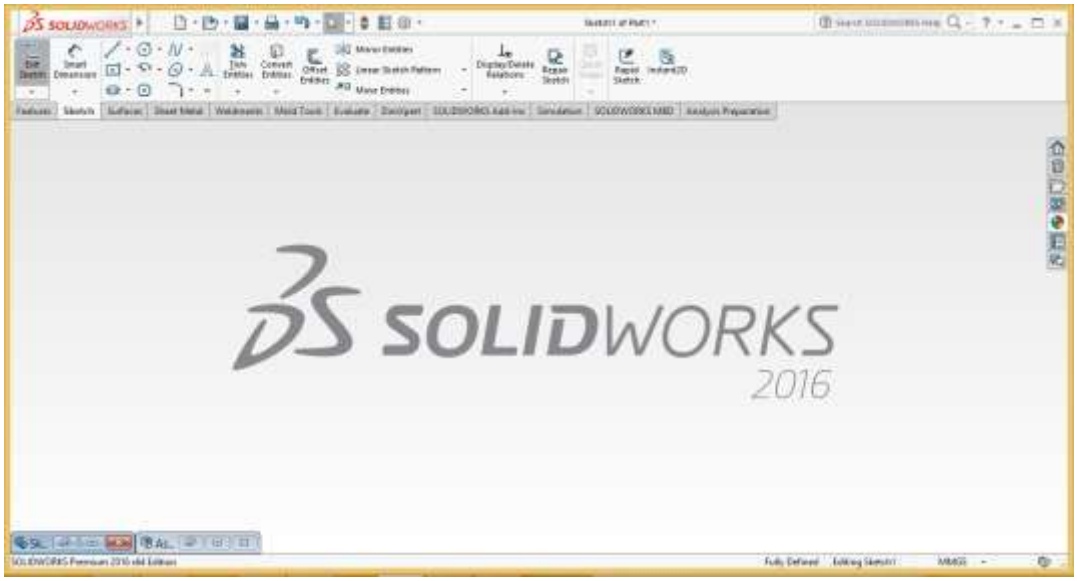


Figure1 : Solid Works Default Page

- By default, no file is opened automatically when you start the program.
- To create a new file, click on file - new or click the new file icon in the main toolbar.
- This will open the new solid works document wizard.

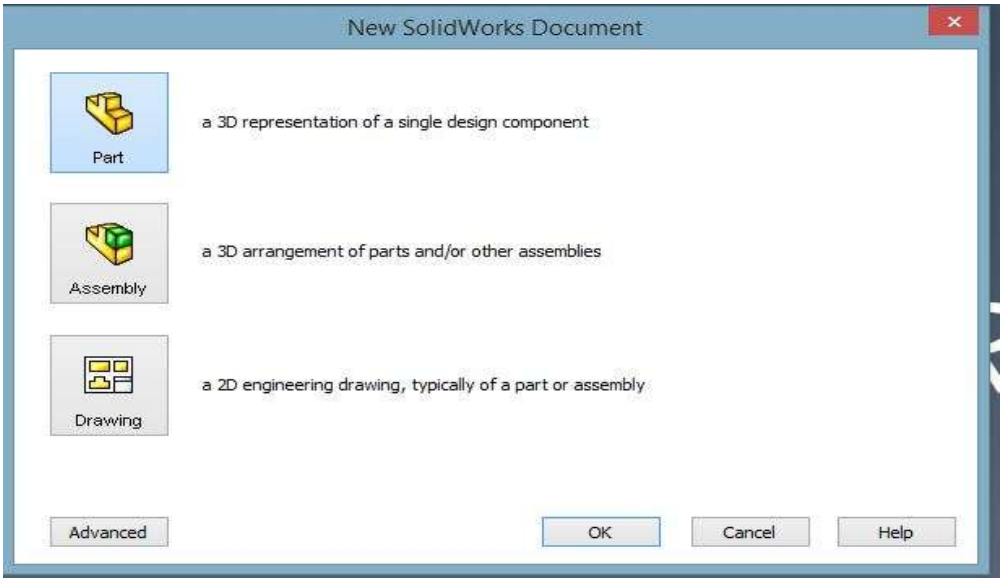


Figure2: Parts of Solid Works

- Let's begin by creating a new part.
- To do this, click on part, then ok. Once you do this, you will be brought into the modeling view which should open several toolbars and panes.

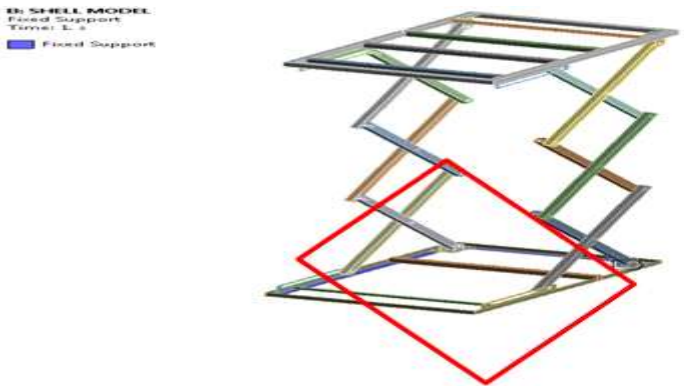
3. FINITE ELEMENT ANALYSIS OF SCISSOR LIFT ASSEMBLY

The principle target of a finite element analysis is to figure impacts of stacking conditions on casing structure. Generally it is utilized to decide the removal, stresses, strains and power responses in structures or parts when exposed to loads that don't incite damping and latency impacts. Suspicions are considered for stacking and reaction conditions i.e., the heaps and structures reaction are expected to static autonomous of time.

3.1 PC Aided Design Modeling of Scissor Lift

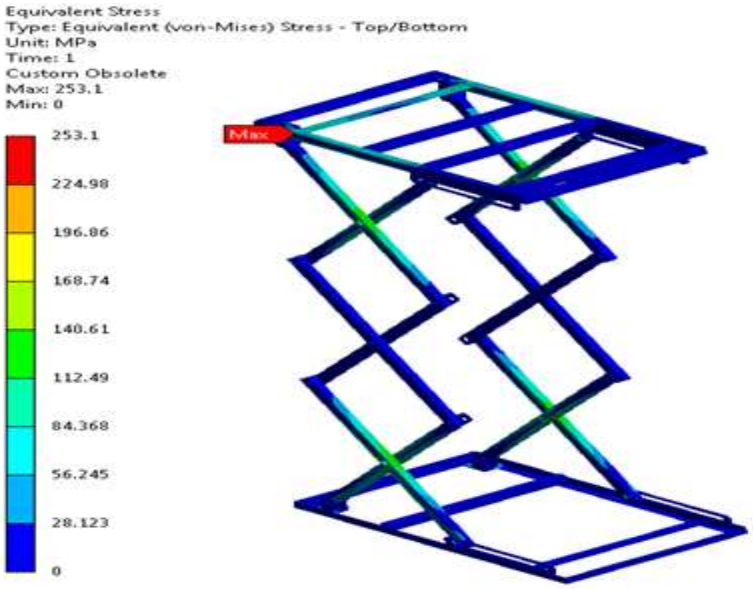
Geometry cleaning and improvement has been done on Scissor Lift Assembly. Finite element models to perform static basic analysis for base casing and arm joins. Fitting element sizes, refinement and quality parameters have been kept up to guarantee exact outcomes. Appropriate work associations have been kept up. All segments are associated through beam elements and every single electronic part are fixed through reinforced contacts. All parts in lift are displayed with shell elements with fitting thickness.

3.2 Loads and Boundary conditions



3.3 Results of Scissor Lift assembly

Equivalent (Von-Mises) Stress



Maximum equivalent stress was found at corner of the frame structure and its magnitude is 253.1MPa

4.1 Design Calculations

The hydraulic cylinder is mounted in inclined position. The total load acting on the cylinder consists of

Mass to be put on the lift = 1500 kg

Taking FOS = 1.5 for mass in pallet

1500 x 1.5 = 2250 kg

Mass of top frame = 70.5 kg

Mass of each scissor arm = 9 kg

Total mass of four Scissor arms = 108 kg

Mass of links of cylinder mounting = 2 kg

Mass of cylinder = 15 kg

Total Mass = 2475.5 kg

Total load = 2475.5 x 9.81

= 24284.655 N

For a scissor lift Force required to lift the load is dependent on,

Angle of link with horizontal

Mounting of cylinder on the links

The length of the link

Where W = Load to be lifted

$S= a^2 + L^2 -2aL*\cos\alpha$

S = Distance between end points of the cylinder

L= length of Scissor arm= 1.3 m

α = angle of cylinder with horizontal

Now the maximum force will act on the cylinder

When the cylinder is in shut down position

i.e. when the scissor links are closed.

For calculations, we will consider $\alpha = 30^0$

Thus substituting $\alpha = 30^0$,

We get F = 24284.655 N

Selecting 50 mm bore diameter of the cylinder

Area of the bore of the cylinder = $3.14*25^2 = 1962.5\ mm^2$

Pressure = (Force/Area)

$= (24284.655 / 1962.5*10^6) = 123.74$ bar

REFERENCES

[1] **Ren G. Dong**, Christopher S.Pan examined affirmed that expanding the flexbility of the scissor lift structure for the most part builds the tip-over potential. The tip-over edge is a component of both ground incline and tilt speed of the lift.

[2] **M. Abhinay** learned about interest of aerial scissor lifts by organizations is expanding, as they are demonstrating effective in improving their assembling flexibility and yield by giving varible tallness access to their work.

[3] **Zhang Wei** worked on settling of Arm quality issue of the most well known L02 type single hydraulic cylinder SLM is examined in this article in setting of consistent speed lifting.