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## MODELLING AND ANALYSIS OF HYDRAULIC CYLINDER USING ANSYS PARAMETRIC DESIGN LANGUAGE: A REVIEW

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**Abstract:** - Many machines and machine mechanisms run under dynamic working conditions. The vibrations produced under dynamic conditions affect many important design parameters such as strength, production costs, productivity. Fatigue life also plays a vital role in design of any part. For analysis of fatigue life in a high-cyclic range ANSYS is used. This paper focuses on the review of various papers based on the CAD and CAE FEM techniques used by various authors to eliminate or minimize the errors/ failures during the working of hydraulic cylinder. This paper explains the study of the literature, it is considered that the moving load acts on to the beam periodically and dynamic results of these periodical loading are analyzed. According to this analysis, under the longer periodical loading conditions, the dynamic magnification becomes larger. M/s.Vaidharbhi Motors, Morshi Road, Amravati is a small scale automotive service point working from last 10 years in this area, where approximately 25-30 numbers of vehicles daily visited for service and repair purpose. Hydraulic cylinder with ELGI Hydraulic Two Post Lift with Single Cylinder is used by the organization for lifting the vehicle. They want to improve the performance of the available hydraulic cylinder by CAE analysis and want a new improved material suggestion.

**Keywords:** Dynamic analysis, hydraulic cylinder, finite element method, ANSYS, dynamic magnification factor



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## INTRODUCTION

A hydraulic cylinder also called a linear hydraulic motor is a mechanical actuator that is used to give a unidirectional force through a unidirectional stroke. It has many applications, notably in construction equipment (engineering vehicles), manufacturing machinery, vehicle lifting and civil engineering.

An actuation device that makes use of a pressurized hydraulic fluid is known as a hydraulic pump. This mechanism is used for producing linear motion and force in applications that transfer power. In other words, a hydraulic cylinder converts the energy stored in the hydraulic fluid into a force used to move the cylinder in a linear direction.

### 2.0 Operation of a Hydraulic Cylinder:

The hydraulic pressure in these cylinders is in the form of hydraulic fluids that are stored under pressure in these cylinders. The energy stored in these oils is converted into motion. In a complete hydraulic system, a hydraulic motor consists of one or more hydraulic cylinders. A pump regulates the oil-flow in the hydraulic system. The pump is a part of the generator of a hydraulic system. The hydraulic cylinders initiate the pressure of the oil, which cannot be more than that required by the load.



A hydraulic cylinder consists of a cylindrical barrel, piston, and a piston rod. The piston that is placed within the barrel is connected to the piston rod. The cylinder bottom, and the cylinder head, closes the bottom and the head of the barrel respectively. The cylinder head is the side from where the piston rod exits the cylinder.

The cylinder bottom and the piston rod are mounted with mounting brackets or clevises. The piston in the hydraulic cylinder consists of sliding rings and seals. The piston rod chamber and the bottom chamber are the two chambers within the cylinder.

The piston rod starts moving outwards, as the hydraulic fluid is pumped into the bottom side of the hydraulic cylinder. In the reverse process, the hydraulic fluid is pushed back into the reservoir by the piston. The pressure in the cylinder is the ratio of unit force per unit piston area.

The pressure generated in the piston rod chamber is the ratio of the unit load per the difference in the unit piston area and unit piston rod area. This calculation is used when the hydraulic fluid is let into the piston rod chamber as well as the fluid flows smoothly (without pressure) from the piston area to the reservoir. In this way, the expansion and retraction (push and pull) action of the hydraulic cylinder is generated.

The specifications that need to be considered while using a hydraulic cylinder are:

- Bore Diameter: It is the diameter of the cylinder bore.
- Maximum operating pressure: The maximum working pressure a cylinder can carry is known as maximum operating pressure.
- Rod Diameter: It is the diameter of the piston or the rod that are used in hydraulic cylinders.
- Stroke: The distance traveled by a piston in a hydraulic cylinder is known as stroke. The length of a stroke could be several feet, or a fraction of an inch.

### 3.0 Objective of Works

- To perform complete study of existing hydraulic cylinder
- To Create CAD – with actual dimensions of cylinder available in industry
- To analyze the failures in cylinder due to operating condition.
- To find out the failure parameters using software and validate it
- FEM analysis for failure of hydraulic cylinder and suggesting new improved material for improving the performance.

### 4.0 Industry Details

Vaidharbhi Service Centre (Car Repair & Services) is retailer cum service provider; it is in the business of automotive products as well as full-scale automotive services since 2008. This establishment offers comprehensive car and bike care across the city through its wide network,

comprising of multiple stores and mobile vehicles. Find a vast range of automotive products such as tyres, batteries, alloy wheels, oil, accessories and genuine parts for cars, two-wheelers and commercial vehicles. Run by professionals in a professional manner, this dealer looks to deliver beyond expectations when providing world-class products and services to their customer's day in and day out. It employs a proficient and competent team of sales personnel and technicians, who uphold this firm's commitment towards offering impeccable services.



## 5.0 Methodology Planned

### CAD modeling

The essential difference between Pro/ENGINEER and traditional CAD systems is that models created in Pro/ENGINEER exist as three-dimensional solids. Other 3-D modelers represent only the surface boundaries of the model. Pro/ENGINEER models the complete solid. This not only facilitates the creation of realistic geometry, but also allows for accurate model calculations, such as those for mass properties.

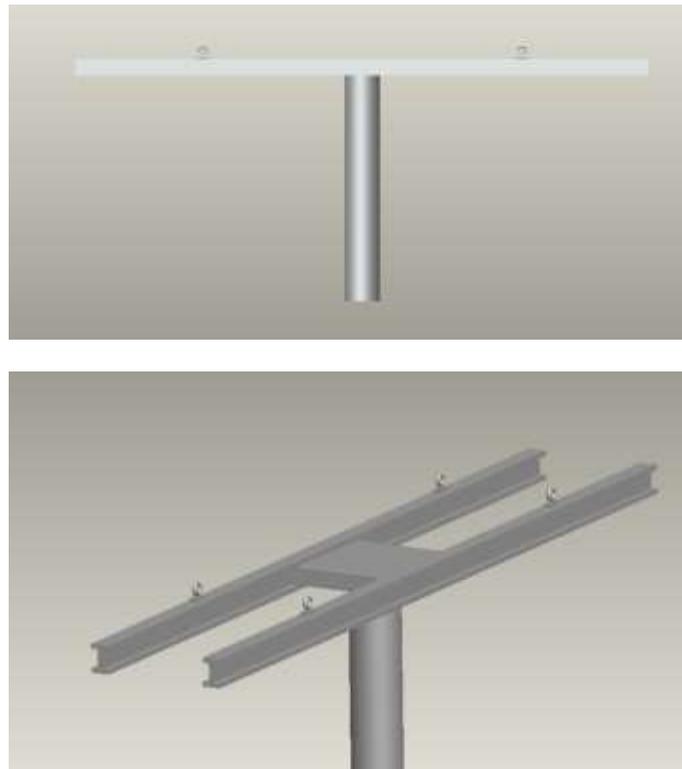


Figure CAD images created by using Pro E Wildfire 4.0 software for testing purpose



Figure Details of Hydraulic cylinder

## 6.0 Conclusion

This paper studies the various parameters important for the CAE analysis of hydraulic cylinder. Also a real problem is under investigation obtained from servicing industry M/s. Vaidharbhi Motors, Morshi Road, Amravati. Design parameters are taken from standard product available and will be tested under CAE software Ansys Workbench. The main aim will be to reduce the working failures and improve the performance of the cylinder. This paper also depicts the review of various papers presented by different author in this field.

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