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Tractor Rear Axle Casing

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Abstract: ***The design of structural modeling is usually based on the different geometric function. Since every component has a definite life span, it is necessary to calculate its core parameters. To find the life span of component, the component must be as input parameter to the Finite Element Analysis. The Finite Element Analysis is nothing but a numerical method for solving Engineering and Mathematical problems. The Analysis of the "Rear Axle Casing of Tractor" using cast iron material with special grade "SG 500" for already existing model, taken in the real time is done by using "ANSYS". The stress, strain, deformation analysis of the component is done by giving various boundary conditions. These analyzed results help to redesign the rear casing of tractor. The redesigning of rear axle casing of tractor is done using "PRO/E". During redesigning the component, various criteria's taken in the real field must be taken into an account. The analysis of the redesigned model is done by giving various boundary conditions for both materials 'SG 500" and "SG 200". Then the stress, strain, deformation, structural supports, structural results are evaluated and also cores, dies and patterns are generated and hence the redesigned rear axle casing of tractor is found to be in safer mode. And also the better material for the rear axle casing is given, by comparing the above mentioned materials.***
Keywords: Rear Axle Casing(Problems, Objectives and Analysis), Structural Analysis.

I. INTRODUCTION OF TRACTOR

The word tractor originated from the Latin word "trahere", meaning pull. Today, tractors are used for drawing in, towing or pulling objects that are extremely hard to move. The tractor on farms which is used to push agricultural machineries or trailers that plough or harrow fields. REAR AXLE CASING The rear axle is one of the components of the tractor which is present in the differential. Its main function is to transmit power from differential to wheel. This component is mounted on the back wheels of the tractor, so it is named as Rear Axle. The rear axle casing is the outer cover of the rear axle. Its main function is to protect the rear axle. The rear axle case is connected to 5 cases of transmission and has an inner peripheral surface, ring gear included in planetary reduction mechanism, ring gear being mounted on inner peripheral surface of rear axle case.

II. TYPES OF REAR AXLES

In rear wheel drive vehicles, the rear wheels are the driving wheels, whereas in the vehicles with front wheels drive the front wheels are the driving wheels. Almost all the rear axles in the modern cars are live axles, which mean that these axles move with the wheels, or revolve with the wheels and are known as live axles. Dead Axles are those axles which remain stationary and do not move with the wheels.

A. Semi-Float Axles

The Semi float axle is used in light trucks and passenger vehicle / buses. In the vehicles equipped with Semi Float axle the shaft as well as the differential housing supports the weight of the vehicle. The wheel hub is directly connected to the axle shaft or is an extension of the same, the inner end of the axle shaft is spine and it is supported by the final drive unit.

B. Three-Quarter Floating

This is a compromise between the more robust full float axle and the simplest semi float type of axle. In Semi Floating axle the bearing is located between the axle casing and the hub instead of being between the axle casing and the shaft as in case of semi float axle. Three quarter floating axles were much popular for cases and lighter commercial vehicles.

C. Fully Floating Axle

Full Float Axle is considered as a robust one and is used for heavy vehicles / trucks meant to carry heavy loads. The axle shaft has flanges at the outer ends, which are connected to the flanged sleeve by means of bolts. There are twotaper roller bearings supporting

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the axle casting in the hub, which take up any side load. Full Float axle is considered asthe most heavy and costly axle.
Forces and torques on the rear axle
Weight of the Body 2.Driving thrust 3.Torque Reaction 4.Side thrust

III. WORKING OF REAR AXLE CASING

The rear axle casing dictates the method that must be used to remove the final drive assembly. Today the casing used will be either a banjo or carrier type. In the past a type known as a split (trumpet) casing was occasionally used. In the banjo axle the tubular axle section is built up of steel pressings welded together and suitably strengthened to resist the bending load. The centre of the casing, combined with the axle tube on one side, resembles a banjo, hence its name. The final drive assembly, which is mounted in detachable malleable iron housing, is secured by a ring of bolts to the axle casing. When this assembly is position, the axle shafts are slid in from the road wheel end of the casing. The casing domed plate is bolted to the rear face of the casing. Removal of this plate allows the final drive gears to be inspected and in case wheel the axle shaft is secured to the differential, the access point enables the axle shaft to be unlocked from the sun gear. The carrier type of axle casing is more rigid than the banjo type casing and is often used to support a hypoid gear final drive unit. The carrier type of axle is therefore fitted to vehicles carrying heavy loads, such as commercial vehicles. The final drive assembly is mounted directly in a rigid, malleable cast iron carrier, into which the axle tubes are pressed and welded. Extra rigidity is obtained by using reinforcing ribs that extend from the pinion nose to the main carrier casting (Fig.16). Access to the final drive gear is by means of a domed plat at the rear of the casing. If repair of the final drive assembly is necessary the use of specialized tools may be required to remove and refit the assembly.

IV. PROBLEM IN REAR AXLE CASING

The failure occurs due to continuous running of the tractor. The failure occurs in the form of crack. During running condition, the tractor lifts and lowers in the bump, mud and

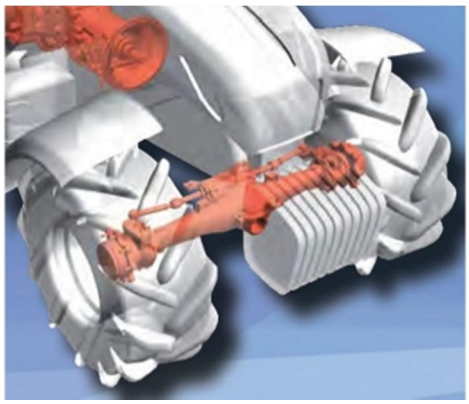

Fig 1 Rear Axle Casing

rock etc., due to that the entire weight, the impact load and vibration acts on the wheels and the axle casing. The axle casing breaks due to the cracks formed during running conditions. Considering the problem and taken in to account, the existing model is fed in to the structural analysis. In this analysis, we predict the maximum stress concentration area. BACKGROUND OF THE PROBLEM The rear axle casing problem occurs only because of continuously running for a long period and also the place where it is functioning. For example highly dry area like where the atmospheric temperature will be more than 39 to 51oC. The company people have a detailed report of it says and out of every 1,000 components 5 components get failed during long running. In this one third of the defective casings is found in dry place area.

V. REAR AXLE CASING

Design of Existing Axle An axle is a stationary machine element and is used for the transmission of bending moment only. It simply act as a support for some rotating body such as hoisting drum and in tractor trolley case the axle is supporting of rotating member known as hub for holding the tires. So the axles are used to transmit bending moment only. Thus axles are designed on the basis of bending moment only. When the axle is subjected to a bending moment only then we get the following data

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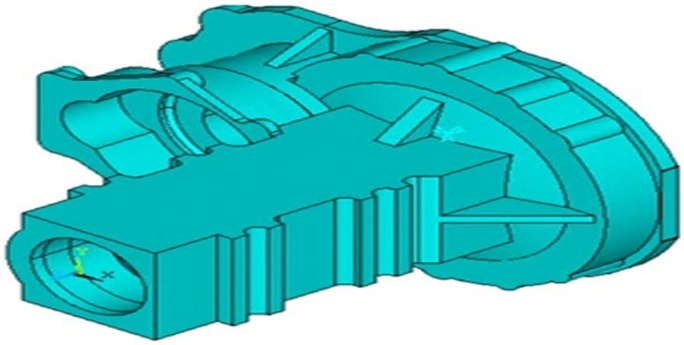

Fig 2 Final model of Rear axle casing

VI. COMPARISION OF MODEL ANALYSIS

The graph for existing modal analysis shows that the frequency of the material is uneven which make reason for earlier failure of the rear casing. The redesigned model on modal analysis shows that the frequency is under limit for the given material for both "SG 500" and "SG 200" respectively in the graph. Comparing the two materials above mentioned, "SG 500" shows a better result.

Table 1 Comparison for Existing and Redesign model

S.No.	Description	Existing model	Redesign model
1	Mass	51.37 kg	51.9 kg
2	Volume	6.54 x 10^6 mm^3	6.61 x 10^6 mm^3
3	Stress	Min : 0.00419 Max: 519.906	Min : 0.00287 Max : 268.475
4	Displacement	Min : 0 Max : 0.7909	Min : 0 Max : 0.303
5	Nodes	69527	87187
6	Element	40468	51737

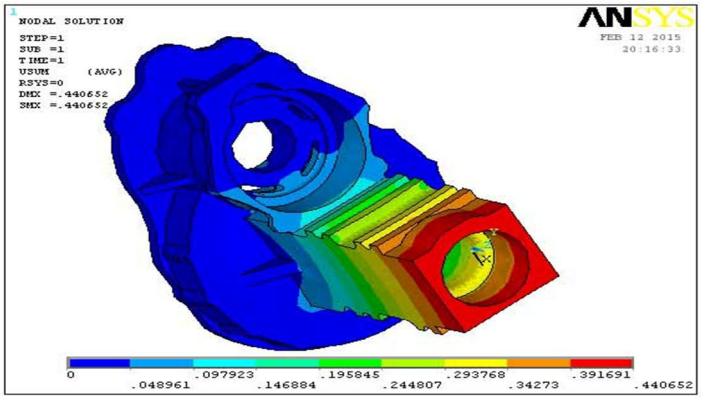

Fig. 2 Remodeling of displacement

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VII. CONCLUSION

Thus the full floating real axle casing component was redesigned successfully using Pro/E wildfire software. The structural analysis and modal analysis of the component were analyzed successfully and the stress, displacement and frequency values are within the Factor of Safety of the material as the result can be compared with the existing model. The redesign rear axle casing mold and die pattern also redesigned. From this analysis report, it is clear that the redesigned model is under safe mode when compared to existing model. Also we can choose "SG 500" is better material for rear axle casing of tractor, when compare to "SG 200" The casting defects are also rectified in the component and manufacturing accessories are retrieved successfully for the redesigned model. From this analysis the designer gets a very good idea about the product in different environment conditions and it also was found that the production rate was increased.

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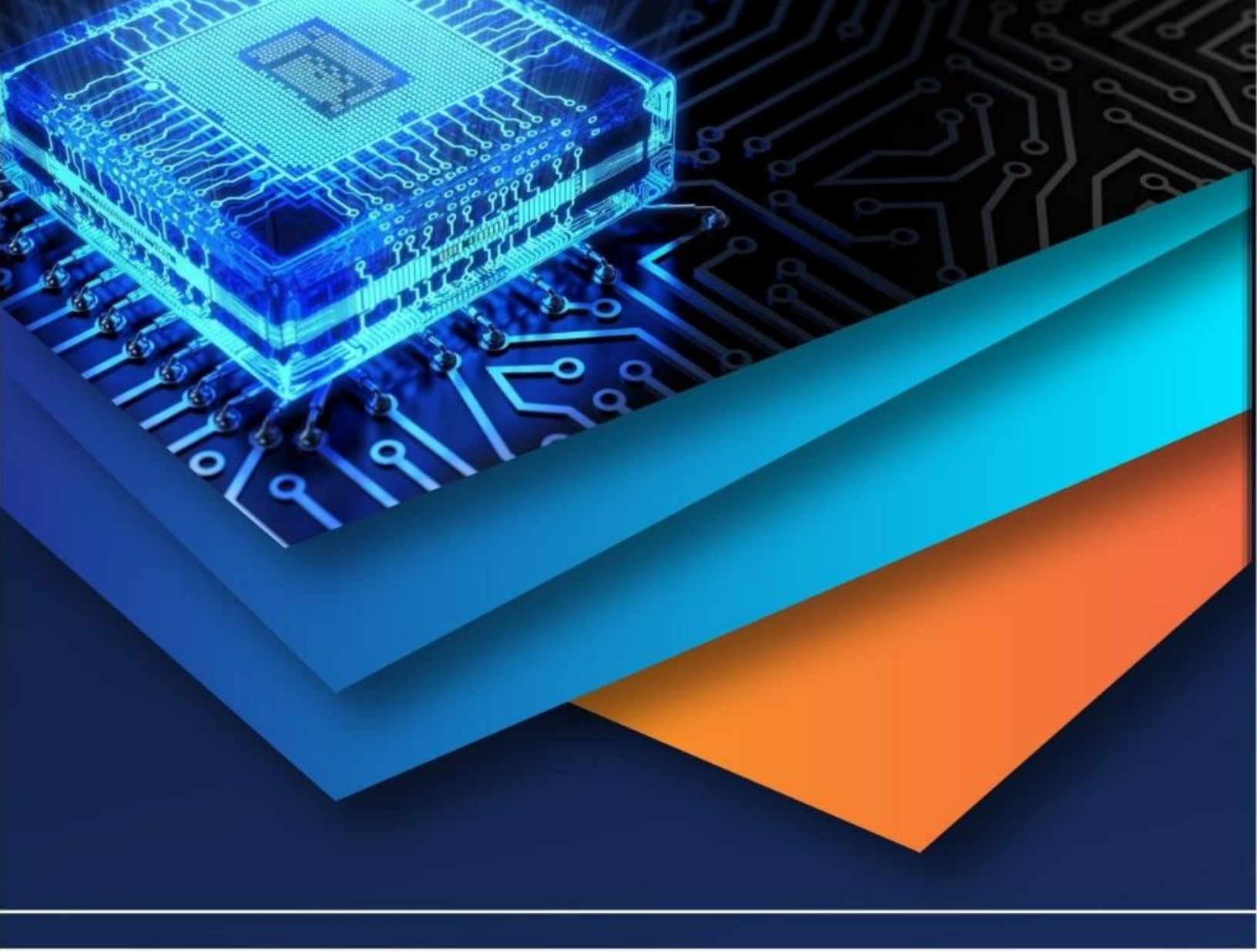

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