

DESIGN AND ANALYSIS OF DIFFERENTIAL GEAR BOX WITH COATED OBJECTIVES TO CONTROL WEAR NATURE IN GEAR BOX

ANGULURI DURGA RAO

Machine Design

Velaga Nageswara Rao College of
Engineering and Technology
prabhaanguluri@gmail.com

KARRA NAMCHARAIAH

Assistant professor

Velaga Nageswara Rao College of
Engineering and Technology
karrachary40@gmail.com

ABSTRACT:

A differential is a tool, normally but now not always employing gears, able to transmitting torque and rotation through 3 shafts. Differential is part of inner axle housing meeting, which includes the differential rear axles, wheels and bearings. The differential consists of a system of gears organized in this kind of manner that connects the propeller shaft with the rear axles. The primary aim of the project is to attention on the mechanical layout and contact analysis on assembly of gears in tools field after they transmit power at specific speeds at 2500 rpm, 5000 rpm and 6000 rpm. The analysis is conducted to verify the pleasant covered fabric for the gears in the gear container at better speeds by using analyzing pressure, displacement and also with the aid of considering weight loss. The mission also focuses on the light weight with coated gears feasibility to govern wear at one-of-a-type speeds. Design calculations are done on the differential of TATA ace by varying materials and speeds. CATIA V5 r19 version used to develop design and ANSYS work bench used for analysis.

Keywords: gear box mechanism, wear, high rpm, coated materials, ANSYS

1.0 INTRODUCTION

A radial load, or overhung load (OHL) as it's also known as, is a bending pressure imposed on a shaft because of the torque transmitted with the aid of belt drives, chain drives, or gears. Radial forces can also be created by way of belt or chain anxiety and by way of a misaligned shaft coupling the motive of a gear discount gadget is to convert input an speed and torque right into a different output velocity and torque. The layout handy requires the usage of gears whose diameters are certain at 24 and 12 inches every. These gears are attached to a shaft whose diameter is exact at two inches, and the bearings, keys, gears, speeds, safety factors, etc need to be decided from statics, strengths, fatigue, and numerous other layout issues. Along

with torque overloading and shock loading, excessive radial loading (overhang load) is one of the pinnacle reasons for gearboxes fail. It is likewise one of the least taken into consideration factors while integrating velocity reducers with equipment, belt, and sprocket drive structures for gear, rolling mills and transmitting equipment. Toothed gears are used to exchange the rate and electricity ratio as well as route among an enter and output shaft. Gears are the most common manner of transmitting motion and power in the modern mechanical engineering global. They form critical factors of mechanisms in lots of machines together with cars, steel reducing gadget

Selection of gearbox:

The team's first idea decided on for the force train changed into guide transmission. The manual transmission works on a set of tools which on moving manually by using the driver produces distinct gear ratios.

Advantages & Disadvantages

- Manual transmission can without difficulty be designed with a reverse gear.
- Cost effective
- Drivers can have higher control over the car as they are able to shift gears every time in distinctive situations
- In guide transmission if the take hold of pedal isn't always well pressed the vehicle can stall.

Also, the presence of a snatch makes the gearbox larger and a bit heavier. The team's 2d concept become to apply an automatic transmission gearbox. This idea of transmission works on a set of planetary equipment machine which connects to the

engine through a torque convertor. The planetary equipment set includes 4 components: sun gear, planet gears, planet carrier, and ring equipment. By locking considered one of them, the planetary set can generate 4 forward and one reverse equipment ratios. Normally an automatic transmission gadget has planetary equipment units with different sizes of solar gears with their planet gears intermeshed. The final choice becomes to use a Continuous Variable Transmission (CVT). A CVT is a pulley system where two pulleys modifications size relative to each other to optimize the engine electricity and to attain endless tools ratios without the want of moving gears. Each pulley has conical plates facing each different at about 17° . With the help of a belt the two cones shifts closer and apart result in changing the rpm of the shaft. The primary benefit of CVT is that it allows the engine to function at premier power for various using situation. Also, CVT weigh a lot lighter than the guide gearbox. A desire of choice needed to be finished among the automated and guide transmission. However, the idea of using an automated or CVT changed into cancelled due to following motives-

- The meeting of automated transmission and the torque convertor could have value tons better.
- Ample area required for set up.
- Specialized experts needed for tuning of CVT

2.0 LITARATURE REVIEW

In 2003, Wang [1] surveyed the nonlinear vibration of tools transmission structures. The development in nonlinear dynamics of tools pushed device is reviewed, in particular the equipment dynamic behavior by way of considering the backlash and time-various mesh stiffness of enamel. The basic concepts, the mathematical models and the answer strategies for non-linear dynamics of geared structures had been all reviewed in his paper.

In 1991, Lim and Singh [2] presented have a look at of the vibration analysis for entire gearboxes. Three instance instances

were given there: a single-stage rotor device with a rigid casing and flexible mounts, a spur equipment pressure gadget with a rigid casing and flexible mounts, and a high-precision spur equipment power gadget with a flexible casing and inflexible mounts.

In 1994, Sabot and Perret- Liaudet [3] supplied every other examine for noise evaluation of gearboxes. A tough part of the noise in the car or truck cab will be attributed by means of the transmission errors which give rise to dynamic hundreds on teeth, shafts, bearings and the casing. During the same 12 months, a simulation method by means of integrating finite detail vibration analysis changed into evolved by others. Each shaft was modeled as a lumped mass and introduced to the shaft of their version. Each of the rolling detail bearings was represented as a spring and damper. The casing of the gearbox turned into modeled with the aid of a thin shell detail inside the finite detail package software.

In 1999, Kelenz [4] investigated a spur tools set the usage of FEM. The contact stresses were examined the use of a dimensional FEM version. The bending strain analysis was achieved on different thin rimmed gears. The contact pressure and bending stress comparisons were given in his research.

Randall and Kelley [5] modifications have been made to Sweeney's simple version to increase it to higher nice gears in which the enamel deflection thing is greater 15 vital. The tooth deflection compliance matrix and the contact compliance vector have been derived the usage of finite element fashions. The results on the transmission mistakes of the variant of the tooth body stiffness with the weight software factor have been investigated, and a simulation program for transmission error (TE) computation with varying stiffness has been developed. In order to examine the case wherein the teeth deflection thing is the dominant supply of the transmission blunders nylon gears were used. All the simulation effects

have been in comparison with the measured transmission mistakes from a single-stage gearbox.

In 1996, Sweeney [6] evolved a scientific method of calculating the static transmission blunders of a equipment set, primarily based on the consequences of geometric parameter variation on the transmission mistakes. He assumed that the teeth (pair) stiffness is consistent alongside the road of action (thin-slice model) and that the touch radius for calculation of Hertzian deformation is the average radius of the two profiles in contact. Sweeney's version is relevant to cases in which the dominant supply of transmission mistakes is geometric imperfections, and is especially suited to automobile great gear evaluation. The consequences of his model gave excellent settlement with measurements on automotive fine gears.

3.0 METHODOLOGY

New advances in laptop era have made finite element stress evaluation a ordinary tool in layout manner has given upward thrust to laptop-aided design (CAD) the usage of solid-frame modeling. Some blessings of CAD are productiveness improvement in layout, shorter lead times in design, extra logical layout method & analysis, fewer design mistakes, extra accuracy in layout calculations, standardization of layout, extra understandability and improved procedures for engineering changes The essential shaft turns in same route as grab shaft. A equipment discount of approximately 2:1 is obtained i.e. The seize shaft turns 2 times for each revolution of primary shaft.

A fundamental knowledge of physics force, torque, electricity, and equipment structures There are numerous critical traits of cars that offer data about a motor and its skills. They are the motor's output torque, its contemporary draw, its output speed, its power, and its efficiency, each of which I will discuss in flip. These characteristics are interdependent and can all be derived from 4 values: the motor's

stall torque, stall modern-day, loose modern, and loose speed.

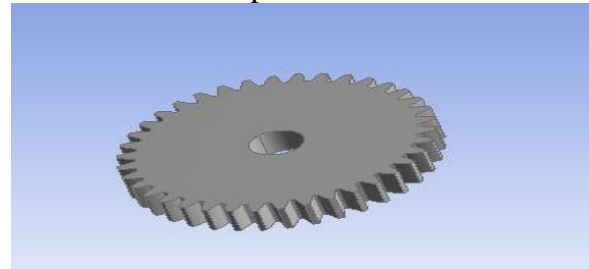
INITIAL SPECIFICATIONS FOR THE GEARBOX:

Power transmitted: 2KW

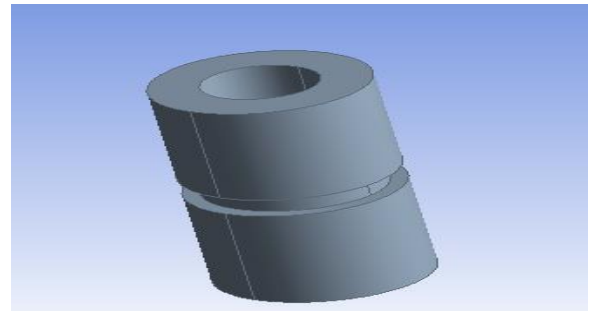
Max. Speed: 1400 rpm

Min. Speed: 460 rpm

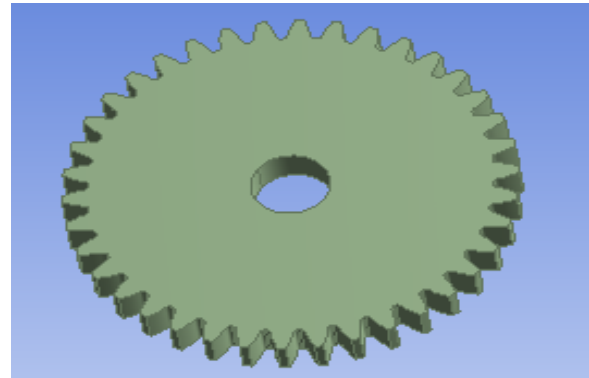
CATIA facilitates the design of digital, electric, and dispensed systems along with fluid and HVAC structures, all of the manner to the manufacturing of documentation for production.



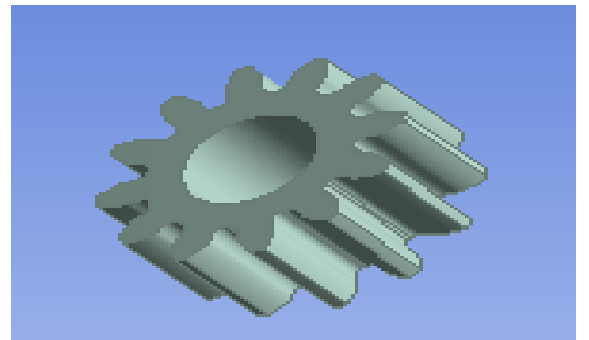
SHIFTER GEAR 3



SHIFTER SPACER



SHIFTER SPACER

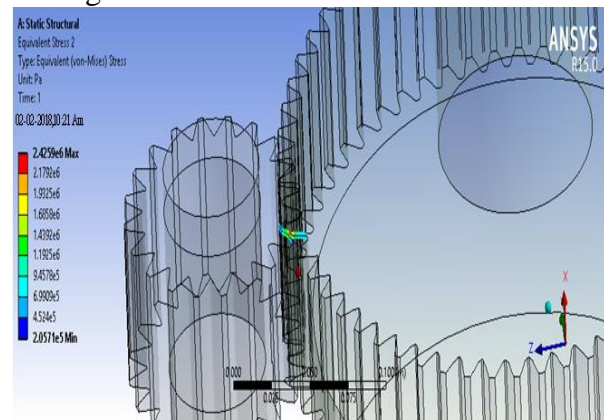


SHIFTER SPACER

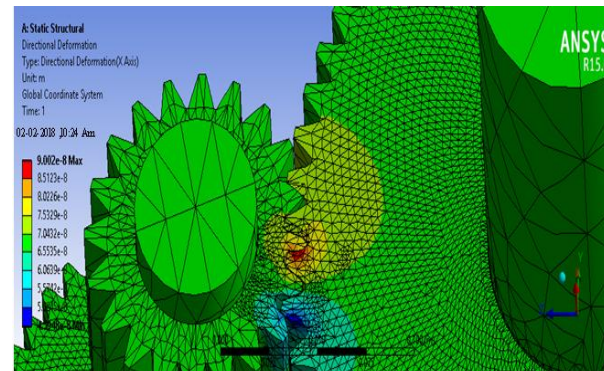
4.0 RESULTS

The fundamental goal of the experimentation changed into to design the arrangement that allows you to predict the tools ratio of the gearbox and to get the motor cutting-edge signature of the input motor. For this the arrangement changed into accomplished and the motor was made to run in numerous RPM which was controlled via the Variable Frequency Drive (VFD). Load was given to the gearbox with the help of the help of the magnetic brake by means of setting the enter voltage with assist of a Variac to sixteen volts. The motor become run on three one of a kind speeds at 2500, 5000 and 6000 RPM respectively and the speed of the pushed shaft changed into measured the use of a Tachometer. Four such readings have been taken each for the 4 exclusive gears. The outcomes of the run are given in the desk underneath:

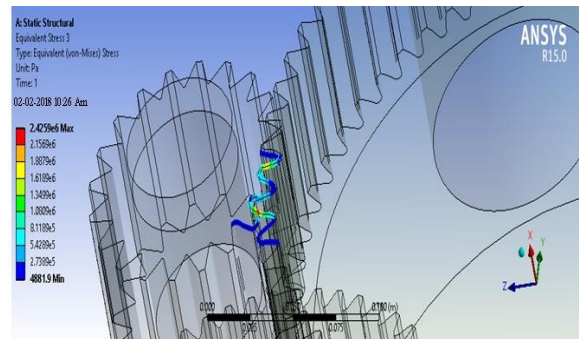
The under parent indicates the equal stresses appearing at the contact edge of the gears most of 2.425e-6Pa was found on the edge.



VONMISSES STRESS USING PROBE



DIRECTIONAL DEFORMATIONS ALONG X AXIS



EQUIVALENT CON MISSES STRESS

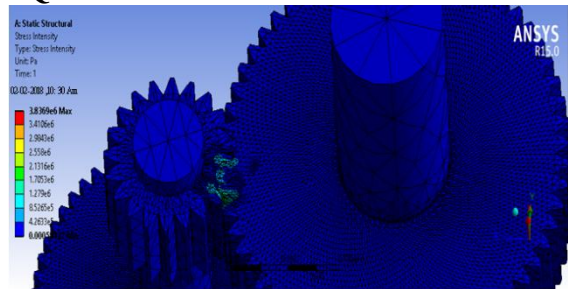
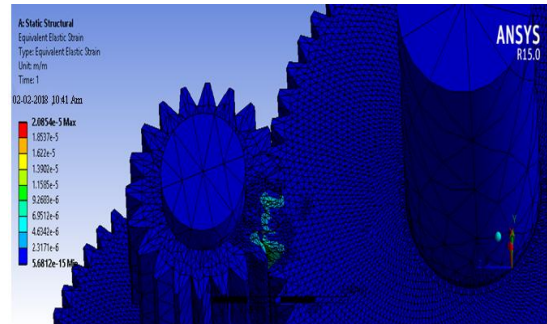
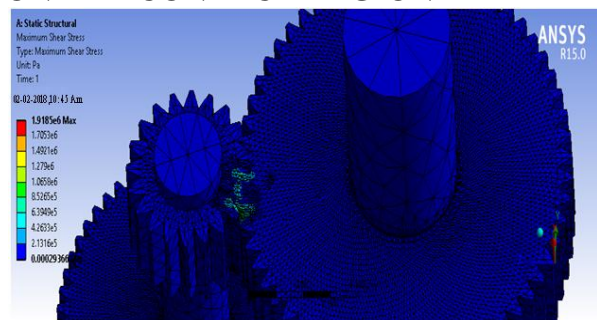


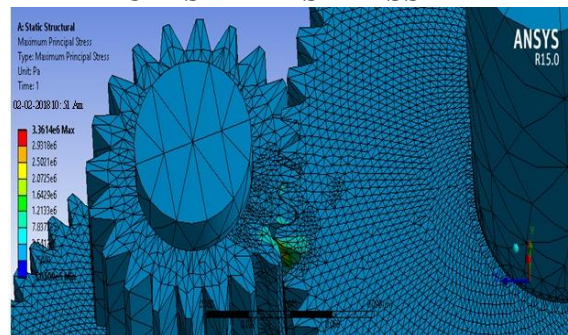
FIGURE 4.4 STRESS INTENSITY ON THE CONTACT REGION



EQUIVALENT ELASTIC STRAINS ON THE CONTACT REGION



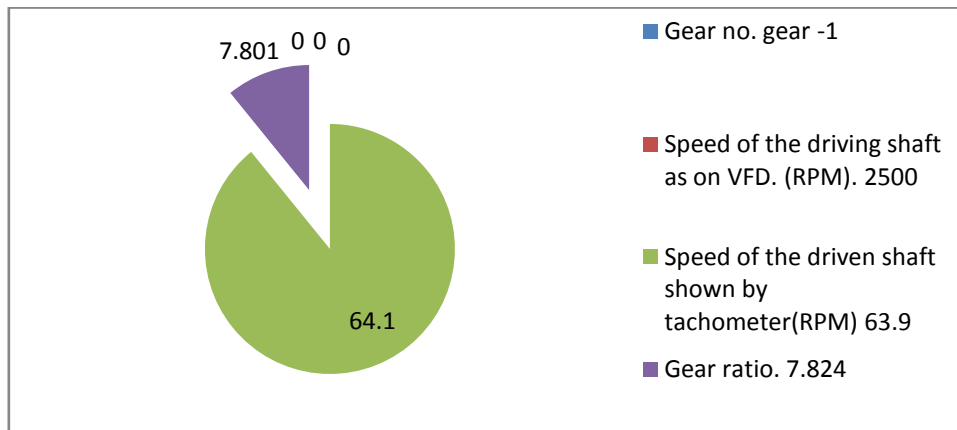
MAXIMUM SHEAR STRESS



MAXIMUM PRINCIPAL STRESS

First gear speed of the driven shaft

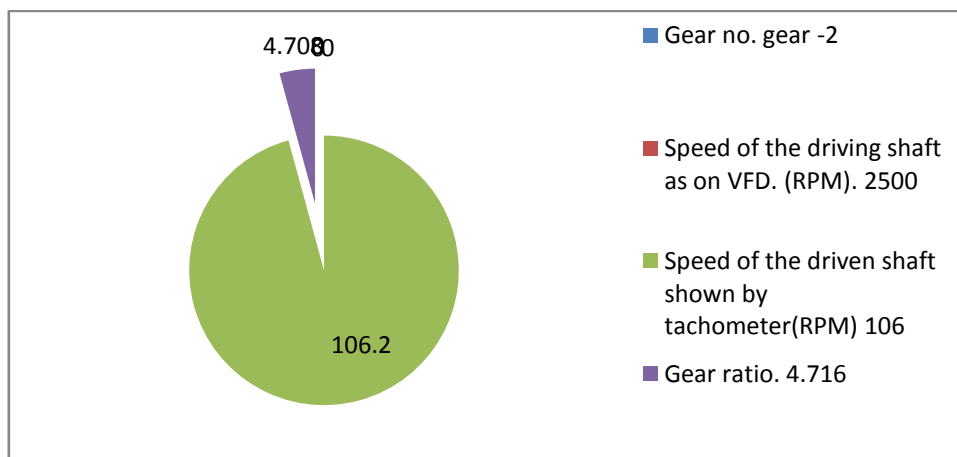
Gear no.	Speed of the driving shaft as on VFD. (RPM).	Speed of the driven shaft shown by tachometer(RPM)	Gear ratio.	Overall gear-ratio
gear -1	2500	63.9	7.824	7.84:1
		64.1	7.801	
	5000	127.8	7.824	
		127.8	7.824	
	6000	254.8	7.849	
		254.7	7.854	



Graph: gear speed of the driven shaft variations

Table 4.2 Similarly for the second gear the speed of the driven shaft

Gear no.	Speed of the driving shaft as on VFD. (RPM).	Speed of the driven shaft shown by tachometer(RPM)	Gear ratio.	Overall gear-ratio
gear -2	2500	106	4.716	4.71:1
		106.2	4.708	
	5000	212	4.716	
		211.9	4.719	
	6000	424.8	4.708	
		424.8	4.708	



CONCLUSIONS

The restricted element research of triple lessening gearbox that constitutes the driving tool of a twofold bascule versatile extension was executed. The triple lessening helical gearbox was a three segment gearbox transmitting with a diminishment share of the heap estimation for helical rigging was executed utilizing the CAD Software package. The responses were applied to apply burdens to the limited aspect version of accommodations (packaging). Geometric model of triple diminishment gearbox packaging become assembled utilizing CATIA and healthy using the ANSYS restricted thing program. Static primary research changed into performed using a combination of shell and strong components to determine the diversion and to gauge the tension dispersion inside the accommodations. The factor is to enhance the nice via lessening the tension and twisting.

REFERENCES:

- [1] Nil Mangsetty, "Design and Analysis of Composite/Hybrid Drive Shaft for Auto-motives" *The International Journal of Engineering And Science (IJES)* Volume 2, Issue 01, 2013, ISSN: 2319 – 1813, ISBN: 2319 – 1805
- [2] Chaudhary MAK, Hossain RA, *Design analysis of composite drive shaft, International journal of engineering and generation, Vol 2, 2010, pp 45-48.*
- [3] T.Rangaswamy, S. Anantharaman, "Optimal Design and Analysis of Automotive Composite Drive Shaft" *International Symposium of Research Students on Materials Science and Engineering December 2002- 04.*
- [4] M.R. Khoshravan, A. Paykani, "Design of a Composite Drive Shaft and its Coupling for Automotive Application" *Journal of Applied Research and Technology Vol. 10, December 2012, 826-834.*
- [5] Madhu K.S., Darshan B.H., Manjunath K. "Buckling Analysis of Composite Drive Shaft for Automotive Application." *Journal of Innovative Research and Solutions (JIRAS) ISSN: 2320 1932 Volume No.1A, Issue No.2, Page No: 63 -70, Jan – Jun 2013*
- [6] Pollard, *Polymer matrix composite in force line packages. GKN technology, Wolverhampton, 1999.*