TWO STAGE REDUCTION GEAR BOX

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Abstract

Hybrid form of transmission where an integrated control system handles manipulation of the clutch automatically, but the driver can still—and may be required to—take manual control of gear selection. This is sometimes called a "clutchless manual", or "automated manual" transmission. Many of these transmissions allow the driver to fully delegate gear shifting choice to the control system, which then effectively acts as if it was a regular automatic transmission. They are generally designed using manual transmission "internals", and when used in passenger cars, have synchromesh operated helical constant mesh gear sets. This paper discussed about the results of a 2 STAGE REDUCTION transmission project for Mega Atv championship. The main purpose of this project is to provide a gear box with Low reduction ratio, low weight and efficient for engine up to 500cc.

Keywords: *Gear box, hybrid vehicle, efficiency, transmission system, clutches.*

1. INTRODUCTION

It is true that switching over to gear train reduction from a chain improves the gearbox efficiency. It is recognized that a gear reduction will increase the weight of the vehicle but we would like the weight to be minimized so that the drive train weight does not increase the weight of the vehicle by more than 10% of the weight of the previous vehicle. The gearbox manufacturing will result into quick availability to the students participating in various national events for which they require similar type of gearbox as well cost has been reduced drastically so it will be efficient for the students. This gearbox will also help in longer, smoother and efficient working of the machine of all-terrain vehicles that has been connected with the manufactured gearbox unit. This will also help in easier mounting with quick assembly and disassembly of the gearbox to the vehicle.Available gearbox in the market has higher weight. Also these gearboxes are not compact; they are bulky which is unsuitable for all terrain vehicles. Conventional gearbox also is not suitable with reduction ratio compatibility with engines for ATV. The conventional gearboxes are not equipped with suitable torque. For optimal integration of the reduction box to each system and the vehicle there is a minimum distance of six inches and maximum distance of eight inches between the centerlines of each shaft. Aditya et al studied the position of the center of gravity in any vehicle affects the dynamic performance like the maximum tilting angle and maximum acceleration. These dynamic parameters are independent of the engine performance and specifications and depend only upon the constructional details of the vehicle. Chetan et al experimented and calculated on the power and braking requirements. On the basis of these requirements and results, a detailed market study was carried

out and suitable materials, components and parts were selected. All these components were installed, mounted on the roll cage of the ATV thus completing the fabrication process of the vehicle. In this project we are going to manufacture a two stage reduction gearbox. To Design, Analyze the problems being faced in an ATV and overcome all thoseflaws. Major flaws include weight, size and cost. Occasional breakdowns and constantmaintenance have been observed. Design plan includes research and material selectionfor the Casing, Gears and shafts. Gear oil selection is also based on market survey behavior of fluids at a given temperature range. Once the material is selected, thecalculations   for minimum dimensions will be calculated. Standard dimensions similar tothe minimum dimensions are selected and modelled in a CAD software. Various profileshave been created on the components to ensure structural integrity and less weight

The main goal of this new iteration is to add a 2 stage reduction gear to the final drive gearbox without damaging the estimated performance of the vehicle. The final concept selected by the team has shown a theoretical improvement to the vehicle's performance in all categories. In order to reach these comprehensive objectives, the following list of project specifications has been developed.

- Design for CVT is taken from the cvTech bike.

- Retain the current rear suspension mounting locations on the chassis.

- Maintain the current weight distribution at 45/55 longitudinally and 50/50 laterally.

- Match or reduce the weight of the final drive assembly, 19 Kgs.

- Retain the 10:1 final drive ratio.

- The gearbox must stay locked (spooled) to maximize traction and performance.

2. METHODOLOGY OF THE PRODUCT

By studying the gearbox theoretically the various parameters related to the gearbox such as types in gearbox, single stage, multistage gearboxes etc. can be understood.After the detailed study of the gearbox, the calculation of the gearbox will be done by considering various parameters. Reduction ratio is decided according to the comfortable engine provided by considering the MEGA ATV CHAMPIONSHIP event. After the reduction ratio was finalized the diameters of the gears, pinions shaft can be fixed and then the selecting the bearing type as well as sizes for the proper functioning of the gearbox. According to the reduction decided we calculated the teeth for the gears and pinions, also calculated the dimensions for shafts and keys. Finally after all the above calculations it is decided with the calculations for the casing of the gearbox. Once the calculations of the gearbox finalized, start the designing of the gearbox virtually on the software such as Solid works 2013 by considering the calculated parameters of the gearbox. Designing of Solid works 2013 helped with the proper visualization of the gearbox and its orientation accurately. A 3D model was been formed and it was very easy to detect problems and solve them as compared with the theoretical calculations. With the help of Solid works 2013software we were able to assemble the gearbox virtually and also it helped in deciding the tolerances for the bearings and keys selected. The drafting of the gearbox helps for easy understanding of the gearbox with the dimensions and model. The drafting converts the 3D model to 2d drawings with the dimensions provided. The 3D model was formed using Solid works 2013 to check whether the calculations design is correct or incorrect, therefore for the analysis of the gearbox model designed. After doing much iteration and up gradation and

using various steps such as shape optimization factor in ansys, reduced the ample amount of weight considering gearboxes available in the market. Shape optimization factor helped in removing the material from the designed part without affecting the safety factor in the design. Results and design of our project with various analysis software like solidworks 2013 and ansys 14.2.

3. MATERIAL SELECTION

The first step in the gearbox design process is to select the material. A material is to be selected by doing intensive research on the properties of the various materials. A material is to be selected keeping in mind the various parameters like strength weight durability cost and other parameters for the sake of designing gearbox 18CrNiMo case carburized steel is selected as gear material due to its better mechanical properties. Carbon steel is selected as shaft material due to its better mechanical properties. We started with the calculation of the gearbox considering various parameters. Rpm output from the engine. Required rpm on the wheel. Types of reduction gear. Distance between each primary and secondary gears. Torque to be generated. Gear teeth in each gear.

4. DESIGNING OF GEARS

The first criteria in designing the gears is to keep them simple, less weight and at the same time to keep the cost as low as possible. So, the weight and cost have their respective weightage during the design such that both the parameters could be worth enough. The machinability is another important consideration.

Gear 1 – Drive Gear This gear design is done through solid work 2013. And the diameter of the gear is 125.5 inch and it has 57 gear teeth in it. And it act as drive gear

- Module estimation on the basis of beam strength.

- Module estimation on the basis of wear strength.

- Minimum number of teeth to avoid interference.

- For blending and for pitting.
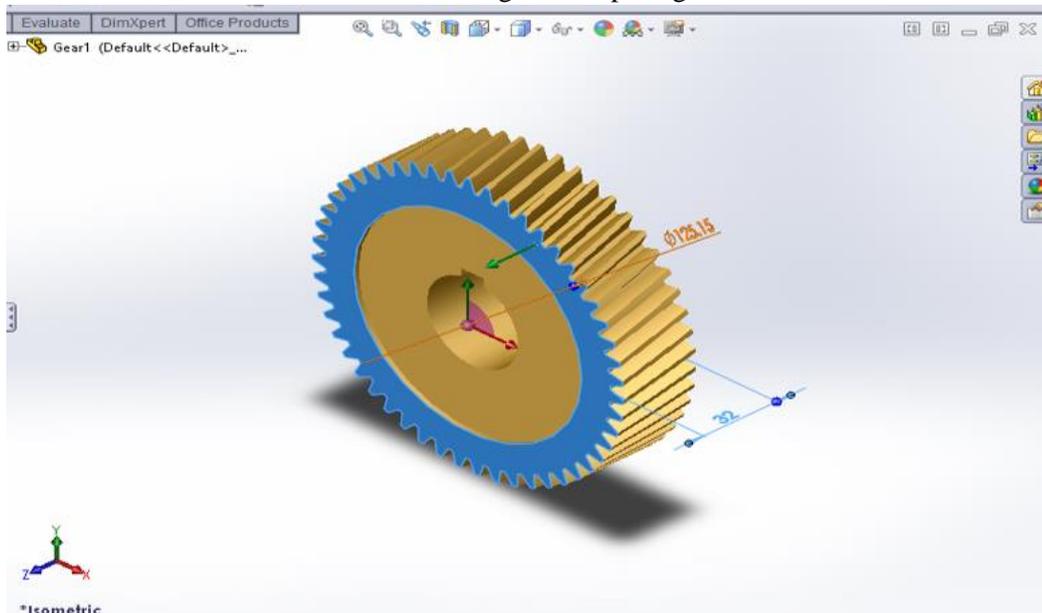
Gear 2 – Driven Gear This gear design is done through solid work 2013. And the diameter of the gear is inch 202.2nd it has 64 gear teeth in it. And it act as driven gear

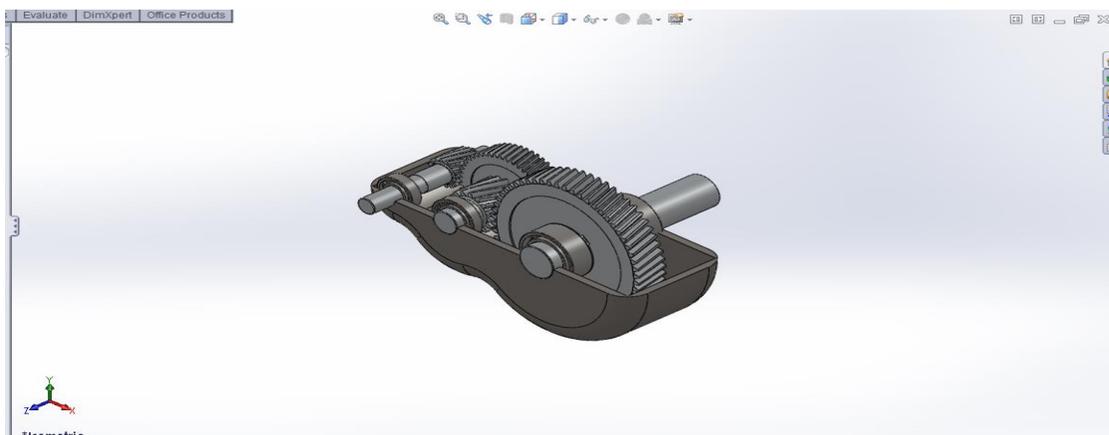- The calculation is same as like 1st Reduction Gear.
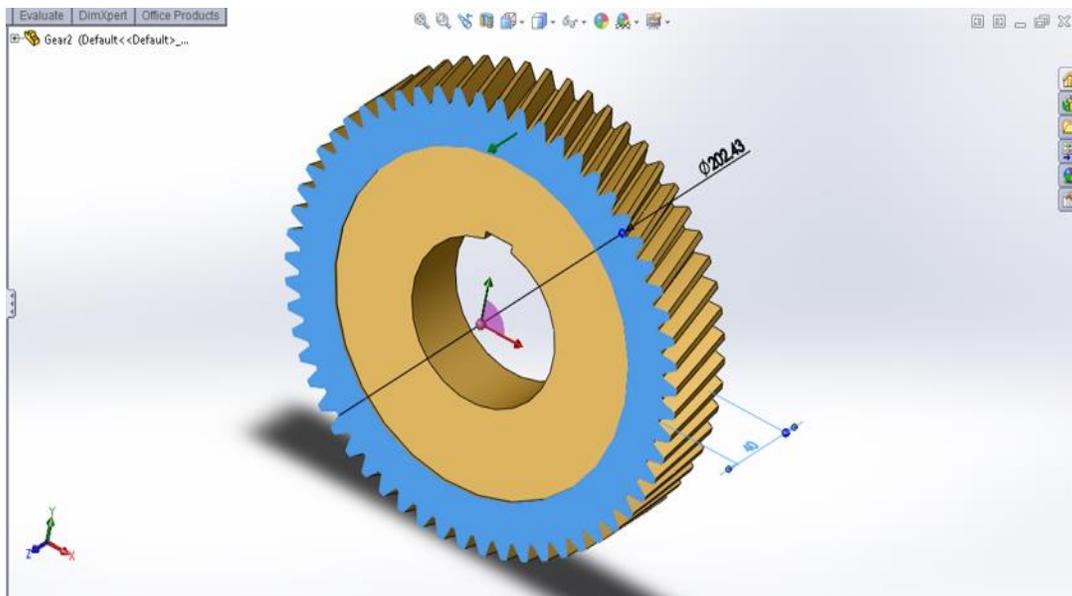
Driver Shaft

This drive shaft is designed in solid works 2013. And the total length of the shaft is 1.2 inch and the spur gear diameter is 0.2 inch and angle inclination of the gear 22.92 degree.
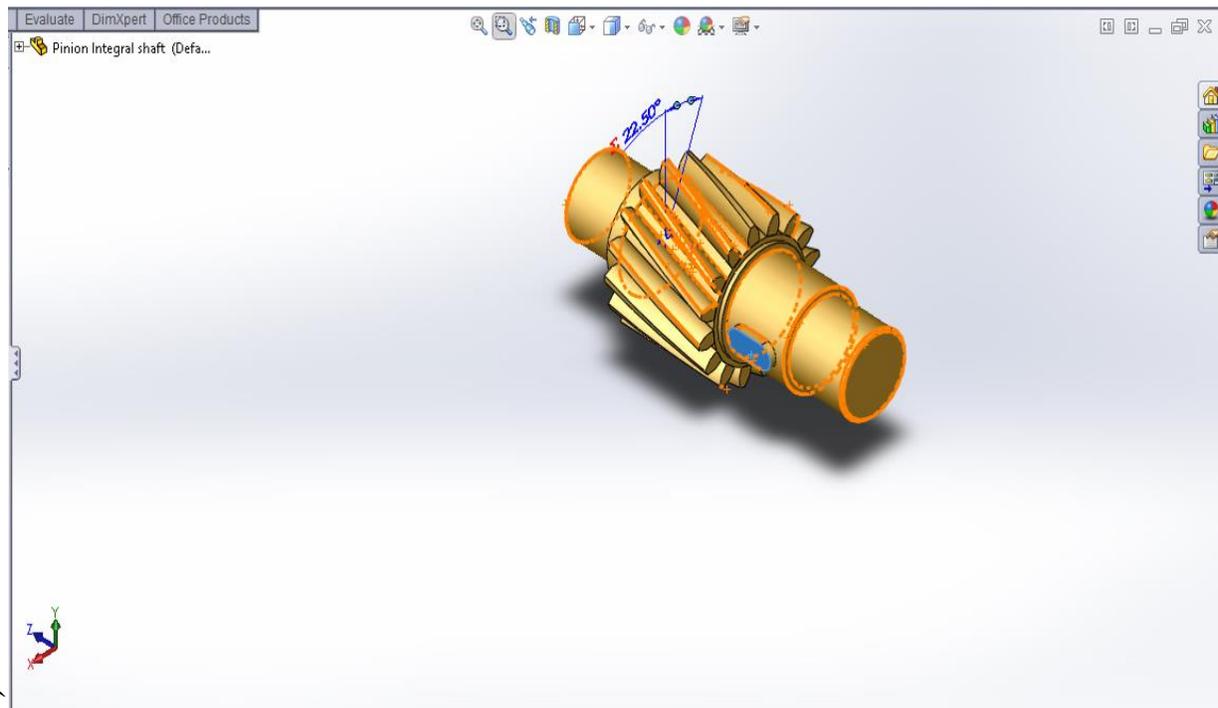
CASING:

This casing is designed in solid work 2013 and it come in both upper and lower casing of the gear box it has oil sump.

Gearbox Casing andGearbox Full Assembly The gearbox is assembled in solid work 2013 and it has 2 reduction gear coupled together to increase the torque of the vehicle.
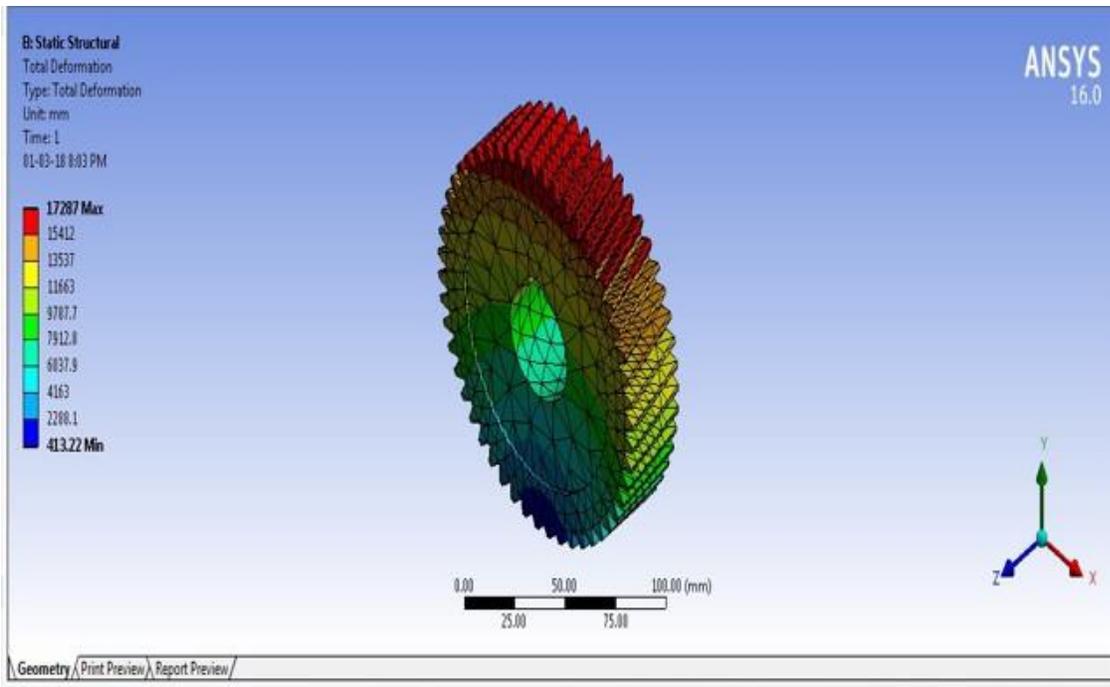
HYPERMESH

Gear Hypermesh in Analysis The meshing of the primary gear is done in Ansys 14 and it has hyper meshed in it.
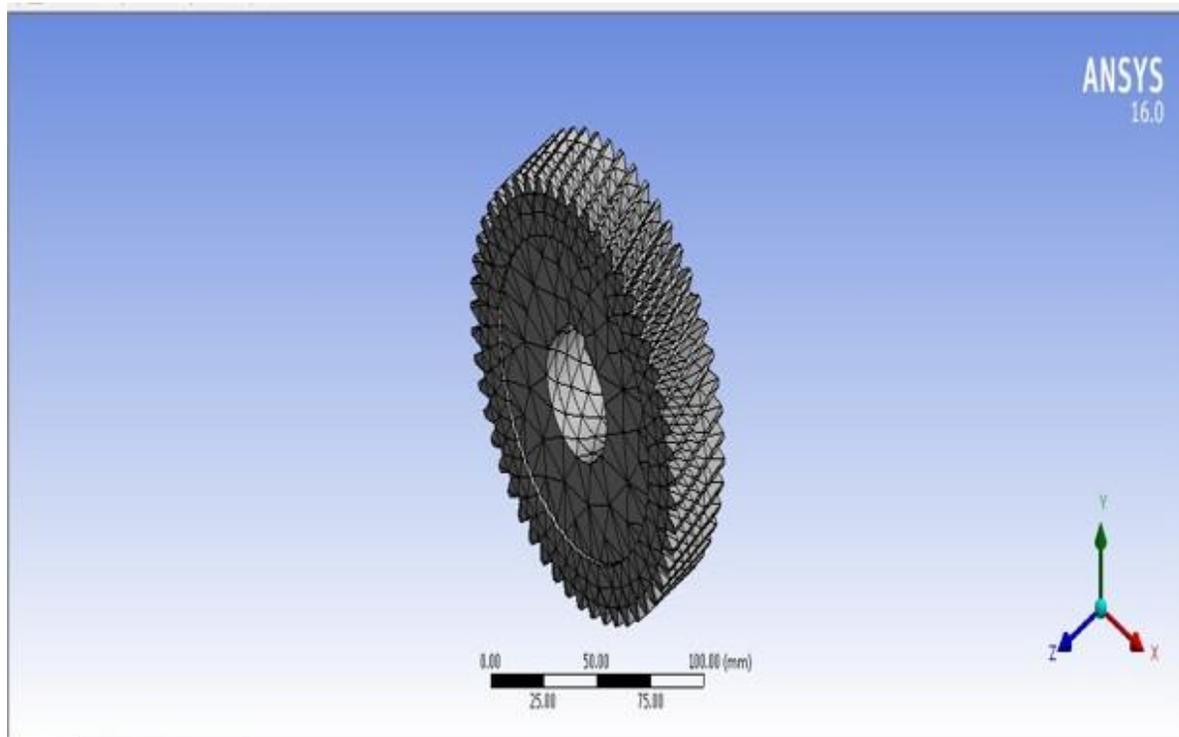
Driven gear in Ansys

Result The analysis is done in Ansys 14 and the maximum and minimum strain applied to the gear is illustrated abe in the picture

5. Result

It is observed that the velocity of oil is maximum at the periphery of the gear showing that the oils is propagating across the gear tooth effectively. At the base of the casing where the oil is accumulated, there is no stagnancy of oil showing that the oil is being continuously recycled throughout. As per the viscosity point of view, the oil is viscous enough to maintain the surface tension when the oil is accumulated between two teeth. That main force that is driving the major part of the oil flow is the intermediate shaft and the stepped gears mounted on it is observed that the maximum velocity of the oil is occurring around the intermediate gears. Therefore, it is concluded that the Intermediate shaft plays an important role in oil propagation and oil flow is efficient in this setup.

6. CONCLUSION

Today's Gearboxes in All Terrain Vehicles occupy more space, heavy and have limited life based on the operation. Operating these Gearboxes for continuously will produce heat that may affect the structural integrity. The Reduction Gearbox designed to be coupled with a CVT that can vary the transmission ratios. The transmission ratio of CVT reduces as the Engine RPM increases. Based on the analytical calculations and Finite Element Analysis we can conclude that all the components are not bound to failure within the given working parameters. The Gearbox is lightweight, compact and has increased life over the conventional Manual Gearboxes. The product design requires the dimensions and their characteristics of different size. Market requirements stipulated that the product needed to be with different size that can fit the circumstances and conditions where it will be used, therefore required product to be with different size that can meet the market demand. Therefore it is essential to create members of family of same products but with different dimensions and characteristics. Usage of computer in the design of these members as well as, usage of computer in creation of construction of a member of family has

considerable effect in shortening the time of product and cost and in increase efficiency and quality of product.

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