

# DESIGN AND ANALYSIS OF A GEAR BOX FOR AN ALL TERRAIN VEHICLE

Akash Vairagade

PG Student:

Department of mechanical engineering  
Abha Gaikwad Patil College of engineering, Nagpur

Dr. Prashant S.Kadu

Principal

Department of mechanical engineering  
Abha Gaikwad Patil College of engineering, Nagpur

**Abstract**-The ATV's are generally small sized, single-scated motor vehicles used for off-road travelling. A two stage reduction gearbox is a part of a transmission assembly which reduces the rotational speed at the input shaft to a slower rotational speed at output shaft. Due to reduction in output speed, the torque of the system is increased. The objective of this paper is to design and analyze the various stresses acting on the gearbox on critical conditions of an ATV vehicle. The gearbox failure reasons are predicted with proper understanding and accordingly analysis is carried out. The gearbox design is modelled on Catia V5 software. The calculations related to the boundary conditions upon which the analysis was performed using Ansys 16.0 software are further verified with theoretical values.

**Keywords**—Truck Body, CATIA V5 Software, Static Structural analysis, FEA, ANSYS.

## I INTRODUCTION

An ATV is a vehicle deigned for off-roading it has to tackle all the muddy areas, rocks, hills and all the obstacles in its way. Due to off-road terrain the friction is low as compared to no roads. It requires high torque when climbing hills as well as while starting the vehicle. When running at high speeds at level mad, high torque is not required e of n because of momentum. For achieving this a compact and lightweight two stage-reduction gearbox required which initially provides high tome by reducing the speed of the shaft. Thus, the output shaft has lower rpm than the input shaft the gearbox also restricts the power flow to the gear train by muntin mg a neutral position.

The gearbox is designed with spur gears having involute tooth profile as they are having highest efficiency and case in design considerations and manufacturing cost. During our study, we found that generally failure occurs in the gearbox when the tooth stress exceeds the safe limit, thus it became as rolling friction: 0014 - 0.03. The total mass of the vehicle is taken to be 260kg. However, the weight distribution is taken as 65:35 necessary to calculate the maximum stresses acting on the gear under the applied boundary conditions. To prevent these failures analysis is performed on the gears.

The gear tooth fails in a number of ways such as pitting, sticking, scuffing, corrosion, scoring, etc., but the main causes are due to bending stresses and contact stresses. Thus, based on our survey we performed analysis on two of the gear materials namely C120 which is commonly used and A1S11060 in an attempt to suggest a better material according to the situation. After that we calculated theoretically the bending stresses by Lewis equation, the contact stress by her equation and finally the deflection by Castigliano's theorem.

Both results which are obtained by analytical and theoretical methods are compared and finally the conclusions are made.

## II PROBLEMDEFINITION

Theoretically and analytically, bending stresses and contact stresses are to be calculated using Lewis equation and Hertz equation.

Deflection is to be calculated by Castigliano's theorem. Both theoretical and analytical results are to be compared analytically

## III. DESIGN PARAMETER

In the design procedure we first targeted the transmission line where in the dimensions of the OEM parts were recorded: Transmission line of the vehicle, where the power is transmitted from engine to cvt to gearbox to shaft through coupling.

we observe that the power coming from the engine is transmitted to the CVT then to the gearbox and from coupling, finally to the shaft. The engine used in the vehicle has a maximum torque of 18.9Nm at 2 pm and max power of 10hp at 3200pm. The kvetch cvt used has a low gear ratio of 3:1. The diameter of Tyre specifications (22. 7-10) with 22" radius

and Static friction: 0.75 as well as rolling friction 0.014- 0.03. The total mass of the vehicle is taken to be 260 kg. However the weight distribution is to be taken as 65:35

#### IV OBJECTIVES

Design and analyze various stresses acting on gearbox. Failure reasons are to be predicted and following analysis is to be calculated

#### VADVANTAGES

- Cost Efficient
- Material Efficient
- Compact design with various transmission ratios
- Wide range of uses
- Time Saving
- Changes can be done easily as per the demand of costumer

#### REFERENCES

1. Bhandari, V. B, "DESIGN OF MACHINE ELEMENTS", Tata McGraw-Hill Education, 2010, Chapter 17
2. J.K. Gupta and R.S.Khurmi: MACHINE DESIGN, Khanna Publications,25th Revised Edition
3. Puttapaka Nagarju, Ch. Ashok Kumar, "MODELLING AND ANALYSIS OF 2-STAGE REDUCTION GEARBOX" International journal and Magazine of Engineering, Technology, Management and Research, ISSN No:2348-4845, Volume NO:1(2014), Issue No:12(December),pp391-398
4. Sushovan Ghosh, Rohit Ghosh, Bhuwaneshwar Patel, Tanuj Srivastav, Dr. Rabindranath Nath Barman "STRUCTURAL ANALYSIS OF SPUR GEAR USING ANSYS WORKBENCH 14.5" International Journal of Mechanical Engineering and Technology (IJMET)Volume 7, Issue 6, November–December 2016, pp.132–141, Article ID: IJMET\_07\_06\_015,pp 132-141
5. Vivek Karaveer, Ashish Mogrekar, T. Perman Reynold Joseph "MODELLING AND FINITE ELEMENT ANALYSIS OF SPUR GEAR" International Research Journal of Current Engineering and Technology, ISSN 2277–4106,Vol.3,No.5,December 2013 PP 2104-2107
6. Anuj Nath, A.R. Nayak "DESIGN AND ANALYSIS OF COMPOSITE SPUR GEAR"ISSN 2348-7550 Volume3, Issue6, June 2015, pp133-139
7. Putti Srinivass Rao, Ch.Vamasi, "CONTACT STRESS AND SHEAR STRESS ANALYSIS OF SPUR GEAR USING ANSYS AND THEORETICAL" International Journal of Modern Studies in Mechanical Engineering (IJMSME) Volume 2, Issue 2, 2016, ISSN 2454-9711, PP 9-14
8. M. Keerthi, K.Sandya, K.Srinivas "STATIC AND DYNAMIC ANALYSIS OF SPUR GEAR USING DIFFERENT MATERIALS"

