

Gear box Test Rig. Using MATLAB

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Abstract:

Transmission is one of the important systems of an automobile and it affects the performance of the vehicle. Gearbox plays an important role in the automobile. So it is necessary to check the gearbox performance prior to its use in the vehicle. There are many tests which are needed to perform to check the performance of the gearbox. While testing gearbox it is required to check the torque carrying capacity of gearbox at given speed. This work presents the development of gearbox tester. Torque carrying capacity of gearbox is tested with the speed. With the help of this we will plot a graph of torque vs. speed, which gives the performance of the gearbox at the rated speed. The graph will be plotted with the help of MATLAB program.

Keywords:

MATLAB, gear box testing, etc.

INTRODUCTION:

An engineer is always focused towards challenges of bringing ideas and concepts to life. Therefore, sophisticated machines and modern techniques have to be constantly developed and implemented for economical manufacturing of products. At the same time, we should take care that there has been no compromise made with quality and accuracy.

The engineer is constantly conformed to the challenges of bringing ideas and design into reality. New machines and techniques are being developed continuously to manufacture various products at cheaper rates and high quality. Necessity:- Today's world requires speed on each and every field. Hence rapidness and quick working is the most important. Nowadays for achieving rapidness, various machines and equipment are invented. The engineer is constantly conformed with the challenges of bringing ideas and design into reality, new machine and techniques are being developed continuously to manufacture various products at cheaper rate and high quality. The machine Trial on gearbox is an innovative project to manufacture having fewer parts. The parts can be easily made in our college. It's price is also less. This project gives us knowledge, experience, skill and new ideas of manufacturing. It is a working project having guarantee of success. This project can be made in less time hence we have selected this project. The machine "GEAR BOX TESTER" is innovative project to manufacture having less parts. Therefore with the help of this we would be able to identify the defects in the tested gearbox.

LITERATURE REVIEW:

Amruta Lomate, Suhas Mohite, and Rahul Shinde. "Design and Development of Torque Testing Rig for a Gearbox." [1]

In today's modern era gears play a vital role in any industry. The gear has much function in an industry to perform right from linking two different components to many others. The main function of the industrial gear drive is to reliably transmit torque and rotary motion between prime mover and driven piece of equipment, at acceptable level of noise, vibration and temperature. When one or more of the preceding operating characteristics exceeds allowable limits, it can lead to failure of the gearbox. Manufacturing companies or customers have to bear big cost and time for the failure of gear drive system during operation.

P. Arun, A.P.Senthilkumar, B. Giriraj, A. Faizurrahman. "Gear Test Rig - A Review" [2]
Power transmitted by Gear boxes were fluctuating strongly in many of the applications. For example, in automobiles, based on the condition of driving, torque and speed varies. In machining operations, based on the material to be machined, torque and speed varies. These evidences show that, test rigs are needed for testing such gear boxes. Performance of gears depends on parameters like its design, material, manufacturing and working environment.

Omkar B Agashe, Mohit H Adgaonkar, Dhawal D Chandegra, Akkshey P Bomble. "Design and Development of Gear Roll Tester." [3]
Gear roll testers are used to measure and analyze functional performance of gears. Gear testing is a technique that has been used in the gear industry to identify potential manufacturing defects in the design intent of the gear that can identify change in backlash, or an unwanted noise and vibrations in a gear mesh therefore, in the present work they have decided to develop a gear roll tester to analyze effects of different types of defects in gear on its functional performance in terms of run out, pitch errors, backlash, profile errors, noise and vibration.

**SYSTEM ARCHITECTURE:
METHODOLOGY**

- The gearbox test rig is based on the concept of

relation between:

- The torque and the speed. Also Power = torque * speed
- Therefore torque is inversely proportional to speed and vice versa.
- The gearbox test rig. Satisfy the above condition for the gearbox tested.
- If torque increase the speed of the gear box decreases the graph of the torque vs. speed is linear (decrease).
- And for the accurate and precise plotting of graph we have used matlab program, so one needs only the reading of measured RPM and putting it in the program for the graph.

Matlab Program

```
>> T= ([ T1 T2 T3 T4 ] ) ;
>> N= ([ N1 N2 N3 N4 ] ) ;
>>plot ( N , T ) ;
>>title ( 'Torque vs Speed' ) ;
```

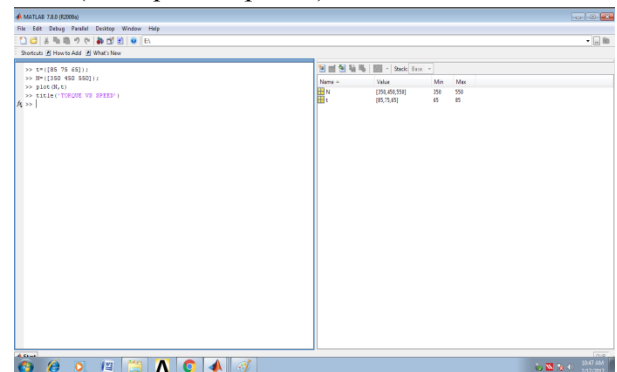


Fig. MATLAB testing window

Our product "GEAR BOX TESTER" gives an easy way to the mechanics in finding the problems of the gear box. In this fast life no one likes to open the gear box or remove the gearbox from the car. As it takes lots of effort and time to remove the gear box and inspect each and every gear and its shaft. Dismantling the gear box is avoided by most of the mechanics and only the head of the mechanics puts his hand in this. "GEAR BOX TESTER" is a simple mechanism and it does not take even 10 mins. to find out the faults in the gear box.

Not removing even a single bolt from your gear box enables you to find the fault in your gear box. You just have to remove your gear box and placed it on the so called “GEAR BOX TESTER”.



Fig. experimental setup assembly

ASSEMBLY PROCEDURE:

Here as we are manufacturing the gear box test rig, we are much more focused on the assembly procedure rather than the process of manufacturing the sub-components in details. Following different components we have assembled together using the process of ‘electric arc welding along with the process of drilling tapping and fixing using the fasteners as nut, bolts and the washers.

- 1 Gear box
- 2 Electric-motor
- 3 Rope brake dynamometer
- 4 Drum with the stand
- 5 Spring balance with the loads
- 6 Frame

ADVANTAGES AND APPLICATIONS:

ADVANTAGES:

- The system gives actual torque value at specified rpm of gear box.
- We can check different types of gear box by changing small modification in our project.
- The value obtain after practical performed was help RND department to improve manufacturing of new gearbox.
- There is a pick up problem in CNG vehicle if we take reading of rpm & torque, we get actual gearing system which solve pick up problem of

vehicle.

APPLICATIONS:

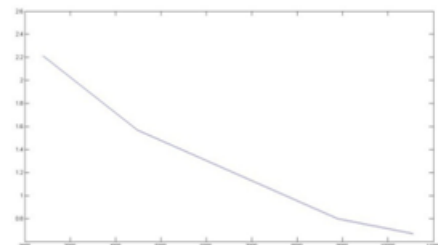
- ❖ It can be installed on amenity vehicles, Viz: cars.
- ❖ It can also be used in heavy vehicles like trucks, buses etc.
- ❖ It can be used in earth movers and the heavy material handling devices.

RESULTS AND CONCLUSION:

By working on our project “GEAR BOX” we came to following different conclusions.

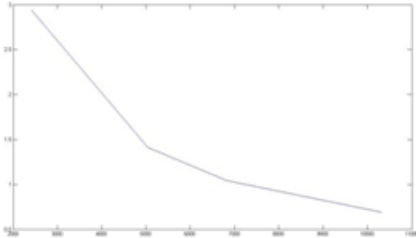
A. Without Defect

GEARS	SPEED IN R.P.M.	TORQUE IN N-M
Ist	2409	2.21
IIInd	4480	1.57
IIIrd	8896	0.807
Top	10551	0.67



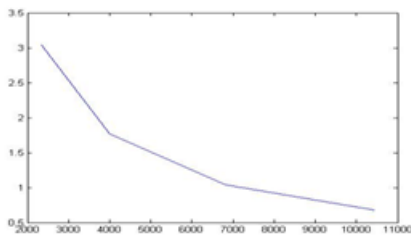
B. With Pitting Defect in Gear-III

GEARS	SPEED IN R.P.M.	TORQUE IN N-M
I st	2415	2.94
IIInd	5045	1.412
IIIrd	6823	1.044
Top	10321	0.690



C. With Wear Defect in Gear-II

GEARS	SPEED IN R.P.M.	TORQUE IN N-M
I st	2343	3.04
II nd	4006	1.77
III rd	6826	1.04
Top	10425	0.6835



From above results we came to know the nature of defect by analyzing the curves in the graph. So by this we can standardize the various defects which will provide particular curves for particular defects.

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