

# Design and Finite Element Analysis of Friction Clutch Plate: A Review

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**Abstract**— In this review paper is to represent a general study on the design and analysis of friction clutch plate. The purpose of a clutch is to initiate motion or increase the velocity of a body generally by transferring kinetic energy from another moving body. In this paper create a clutch plate model in CATIA software and static structural analysis will be done using in ANSYS software.

**Keywords**— Friction clutch plate, CATIA software, ANSYS software

## I. INTRODUCTION

A clutch is a mechanical device that engages and disengages the power transmission, especially from driving shaft to driven shaft. In these devices, one shaft is typically driven by a motor or pulley, and the other shaft drives another device. Clutch plate consists of a clutch plate whose both sides are faced with a frictional material. It is mounted on the hub which is free to move axially along the splines of the driven shaft.

In automobiles clutch is located between the engine and the transmission. When the clutch is disengaged, the power is not transmitted to the rear wheel and the vehicle stops while the engine is still running. The clutch is disengaged when starting the engine, shifting the gears stopping the vehicle and during idle time. The clutch is engaged only when the vehicle is to move and is kept engaged when the vehicle is moving. When properly operates it prevents jerky motion of the vehicle.

## II. MATERIAL USED IN CLUTCH PLATE

### A. Splined Hub

EN8 this types material are medium strength steel and good tensile strength.

### B. Chemical Composition

Carbon	-	0.36-0.44%
Silicon	-	0.10-0.40%
Manganese	-	0.60-1.00%
Sulphur	-	0.050 Max
Phosphorus	-	0.050 Max

### C. MS Sheet:- EN3B

Carbon	-	0.16-0.18%
Silicon	-	0.40% max
Manganese	-	0.70-0.90%
Sulphur	-	0.040% Max
Phosphorus	-	0.040% Max

Springs :- EN 49

Rivet:- EN3B

## III. LITERATURE REVIEW

### A. Rajesh Purohit, Pooja Khitoliya.

In the present work a friction clutch assembly was designed and a model of the same was created in Solid Works Office Premium Software. It consist of three parts viz. clutch plate, pressure plate and diaphragm spring. Finite element analysis was performed in ANSYS software. The finite element analysis was carried out in three steps: Preprocessing, Solving and Post processing. The plots for Equivalent von-Mises stress, total deformation and stress tool (factor of safety) were calculated and analyzed. The finite element analysis showed that the designed friction clutch assembly is safe.

### B. Muhammad Zahir Bin Hassan, Muhammad Fahmi Bin Md Isa

This paper investigates the structure analysis of cast iron for dry clutch disc of amphibious vehicle. The main focus that needs to be considered is the torque produced from the engine. Optimum parameters must be justified in order to confirm the clutch disc is high durability, high reliability, and minimum in weight. Finite element analysis is use to predict the maximum stress can be apply to the disc.

### C. N. V. Narasimharao.L, Ch. Chandrarao

The objective of this thesis is to investigate how a crack propagates and grows in a clutch. The finite element program ANSYS is used to simulate crack growth and to compute the stresses and the stress-intensity factor. A Geometric model of clutch was designed in 3D by using software Pro/Engineer. Later the geometric model of the clutch converted into FEM model and get analysed by using ANSYS software to predict the analysis results.

### D. V Mani Kiran Tipirineni, P. Punna Rao

The Finite Element Analysis providing a means for non-destructive analysis, which is used to analyze the clutch driven plate. The results from the FEA are accurate and hence being used worldwide for design and research engineers. The driven plate used in Leyland Viking Vehicle is analyzed in this work. The driven main plate failed normally during its operation due to cyclic loading. This project explains the structural design analysis of the clutch plate and find out the failure region by doing static analysis in ANSYS software. The 3D model of clutch plate was drafted using Solid works software and analysis of the plate was done for static loading condition. This project finds the maximum stress in failure region during operation. This project also suggests

three design modifications to the company to improve the lifetime of the clutch plate.

#### E. Kong Guoling, Zhong Zaimin, Yu Zhuoping

Clutch torque transfer feature is the most important feature of clutch, which decides the performance of clutch directly, the acquisition of the torque feature would be a guide and active factor for launch process and shifting process. A new method of calibration of clutch torque transfer feature based on constant engine speed launch control is proposed in this paper, and this control algorithm is validated through the simulation, and the results show excellent performance of the calibration of the clutch feature, this method lowers the threshold to obtain the clutch torque transfer feature and the dependence on the equipment, which would be a active impaction on the AMT clutch control

#### F. Mamta G. Pawar, Monarch K. Warambhe, Gautam R. Jodh

Clutch system is among the main systems inside a vehicle. Clutch is a mechanical device located between a vehicle engine and its transmission and provides mechanical coupling between the engine and transmission input shaft. Clutch system comprise of flywheel, clutch disc plate and friction material, pressure plate, clutch cover, diaphragm spring and the linkage necessary to operate the clutch. The clutch engages the transmission gradually by allowing a certain amount of slippage between the flywheel and the transmission input shaft. However, the slipping mechanism of the clutch generates heat energy due to friction between the clutch disc and the flywheel. At high sliding velocity, excessive frictional heat is generated which lead to high temperature rise at the clutch disc surface, and this causes thermo-mechanical problems such as thermal deformations and thermo-elastic instability which can lead to thermal cracking, wear and other mode of failure of the clutch disc component. In this project, the modeling of clutch is done in detailed using modeling software. After that the FEM analysis is done for sintered iron friction material. The stresses & deformation obtained for this friction material is then compared to analysis software result. The analysis is done for worn out friction disc.

#### IV. CONCLUSION

First of all, analysis of the static calculation of friction clutch plate are give the CATIA software and ANSYS software to showed that the design of friction clutch plate is safe. Secondly, the experimental study allowed to observe the clutch plate strength and how many deformations are present in clutch plate.

#### REFERENCE

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