

A Review on Static and Dynamic Analysis of Automotive Clutch for Material Optimization

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Abstract

A clutch in automotive transmission systems plays a distinctive role to disengage gearbox from flywheel while engaged to transmit power from flywheel to entire transmission system with zero percentage slip. It is necessitates to increase the performance of clutch in transmission systems. The performance of clutch depends on two factors, material of the clutch system and mechanisms of clutch systems. In this study, Material of the clutch system will be taken into account. The single plate clutch will be modelled in CAD software CREO/CATIA and analysis will be done using ANSYS R19 Multiphysics software. Detailed explanation of clutches and comparison of different material for clutch will be analyzed for deformation and maximum stress in static analysis and natural frequency by doing vibration analysis. Best material among belo will be proposed based on FEA results.

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I. INTRODUCTION

A clutch in automotive transmission systems plays a distinctive role to disengage gearbox from flywheel while engaged to transmit power from flywheel to entire transmission system with zero percentage slip. It is necessitates to increase the performance of clutch in transmission systems. The performance of clutch depends on two factors, material of the clutch system and mechanisms of clutch systems. In this study, Material of the clutch system will be taken into account. The single plate clutch will be modelled in CAD software CREO/CATIA and analysis will be done using ANSYS R19 Multiphysics software. Detailed explanation of clutches and comparison of different material for clutch will be analyzed for deformation and maximum stress in static analysis and natural frequency by doing vibration analysis. Best material among belo will be proposed based on FEA results.

Material Considered for study:

1. CI(cast iron)
2. Structural steel
3. Stainless steel
4. AL Alloy
5. Composite Material(Carbon Fiber)

II. LITERATURE REVIEW

1. The paper published by Mamta G. Pawar- 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.

2. Shrikant V. Bhojar - A simple transmission system consisting of engine, clutch, gearbox and load is designed for the load lifting application. Stiffness of all the three shafts have been calculated and equivalent stiffness is calculated. Equivalent mass moment of inertia is also calculated. From this data, using the concepts given by Prof. DOW, duration of engagement period is calculated for the selected power transmission system and energy dissipated during engagement is also plotted as a function of time.

3. Anil Jadhav - Depicts a solid modelling of multiplate clutch with PRO-E CAD package that is employed for varied automotive applications. The structural analysis of clutch plate is done over cork, copper and SA92 as friction lining materials. The analysis is carried out on ANSYS workbench to get the foremost appropriate friction material for clutch. From the analyzed results, stress, strain and total deformation values were compared for all the three materials and the best one was taken out.

4. Prafull. S. Thakare - Clutch is a device used in the transmission system of a vehicle to engage and disengage the transmission system from the engine. The clutch works on the principle of friction. This paper discusses detailed study of single plate clutch. In this paper, detail study of clutch and modeling of clutch is done in proe software. Assembly of different parts of the single plate clutch is also done in software.
5. Nitinchandra R. Patel - The centrifugal clutch offers many advantages in motor and engine drive applications. Utilizing the centrifugal clutch enables the selection of normal torque motors for running loads rather than the selection of high torque motors for starting loads. The aim of this project is to be describing the torque carrying capacity at different speed which using in transmitting power.
6. V Mani Kiran Tipirineni - 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.

III. CONCLUSION

From many research and article papers we are taken above literature for our project study and from them we are understood the working of clutch plate and clutch materil while torsion and friction loads acting on it. We have studied about clutch plate and various materials of clutch plate.

Other then reference and literature We have done basic preparation and analysis of this particular project and also calculated mathematical data of the clutch plate and various material, we also have practised with the CAD and Solid Works for designing and ansys for analysis.

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