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DESIGN AND STUDY OF A MULTI PLATE CLUTCH

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A B S T R A C T

Clutch is mechanism which transfers the rotary motion of one shaft to the other shaft when desired. In automobiles friction clutches are widely used in power transmission applications. To transmit maximum torque in friction clutches selection of the friction material is one of the important tasks.In this thesis, the general introduction to the arrangement, design and some basic concept of multi plate wet type clutch. Fluid plays an important role in this type of clutch so some of their properties are discussed. Some losses due to design parameters are also discussed. This gives better understanding about working principle of clutch, material used for making the clutch plates. Effect of design consideration can be further studied during its application in various conditions.In this paper, we design a multi plate clutch by using empirical formulas. A 2D drawing is drafted for multi plate clutch from the calculations & a 3D model is created in the modeling Software CREO for Automobile Applications. Analysis done in ANSYS with different materials.Static analysis to determine the deformation, stress and strain for the single plate clutch. Modal analysis is to determine the deformations with respect to frequencies.

Key words: multi plate clutch, Steel, Aluminium alloy, CREO, Ansys Workbench, etc.

I INTRODUCTION

INTRODUCTION OF CLUTCH

The clutch is a mechanical device, which is used to connect or disconnects the source of power from the remaining parts of the power transmission system at the will of operator. The clutch can connect or disconnect the driving shaft and driven shaft. An automotive clutch can permit the engine to run without driving the car. This is desirable when the engine is to be started or stopped, or when the gears

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to be shifted. Clutch is a mechanism for transmitting rotation, which can be engaged and disengaged. The clutch connects the two shafts so that they can either be locked together and spin at the same speed (engaged), or be decoupled and spin at different speeds (disengaged). Depending on the orientation, speeds, material, torque produced and finally the use of the whole device, different kinds of clutches are used. The clutch in itself is a mechanism, which employs different configurations. The friction clutch is an important component of any automotive machine. It is a link between engine and transmission system which conducts power, in form of torque, from engine to the gear assembly.

INTER-LOCKING PARTS CLUTCHES

This type of clutch has protruding circular edge and a hole for them that engages and disengages during operation. This type is less effective since human foot or hand power on clutching reaches about 10 KN or 1,000 kg.

FRICTION CLUTCHES

A friction clutch the vast majority of clutches ultimately rely on frictional forces for their operation. The purpose of friction clutches is to connect a moving member to another that is moving at a different speed or stationary, often to synchronize the speeds, and/or to transmit power. Usually, as little slippage (difference in speeds) as possible between the two members is desired.

MATERIALS

Various materials have been used for the disc-friction facings, including asbestos in the past. Modern clutches typically use a compound organic resin with copper wire facing or a ceramic material. Ceramic materials are typically used in heavy applications such as racing or heavy-duty hauling, though the harder ceramic materials increase flywheel and pressure plate wear.In the case of "wet" clutches, composite paper materials are very common. Since these "wet" clutches typically use an oil bath or flow-through cooling method for keeping the disc pack lubricated and cooled, very little wear is seen when using composite paper materials.

MULTIPLE PLATE CLUTCH

This type of clutch has several driving members interleaved or "stacked" with several driven members. It is used in racing cars including Formula 1, IndyCar, World Rally and even most club racing. Multiplate clutches see much use in drag racing, which requires the best acceleration possible,

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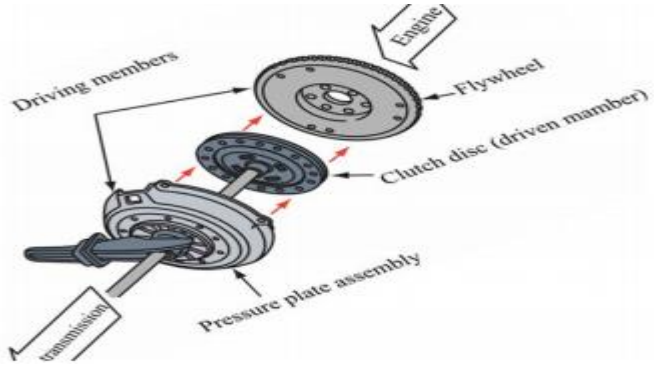
and is notorious for the abuse the clutch is subjected to. Thus motorcycles, automatic transmissions and in some diesel locomotives with mechanical transmissionsIt is also used in some electronically controlled all-wheel drive systems as well as in some transfer cases. They can also be found in some heavy machinery such as tanks and AFV's (T-54) and earthmoving equipment (front-end loaders, bulldozers), as well as components in certain types of limited slip differentials. The benefit in the case of motorsports is that you can achieve the same total friction force with a much smaller overall diameter (or conversely, a much greater friction force for the same diameter, important in cases where a vehicle is modified with greater power, yet the maximum physical size of the clutch unit is constrained by the clutch housing).



LITERATURE REVIEW

In this thesis, the general introduction to the arrangement, design and some basic concept of multi plate wet type clutch. Fluid plays an important role in this type of clutch so some of their properties are discussed. Some losses due to design parameters are also discussed. To meet the requirements of low fuel consumption, good driving performance and manufacturing feasibility. This paper will provide a design overview of the transmission architecture, main characteristics, key subsystems and control strategies. This gives better understanding about working principle of clutch, material used for making the clutch plates. Effect of design consideration can be further studied during its application in various conditions. In this paper, we design a multi plate clutch by using empirical formulas. A 2D drawing is drafted for multi plate clutch from the calculations & a 3D model is created in the modeling Software Pro/E for Automobile Applications. We have conducted structural analysis by varying the friction surfaces material. By extracting the results Comparison is done for both materials to validate better

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lining material for multi plate clutch to find out which material is best for the lining of friction surfaces. Analysis is done in ANSYS software.

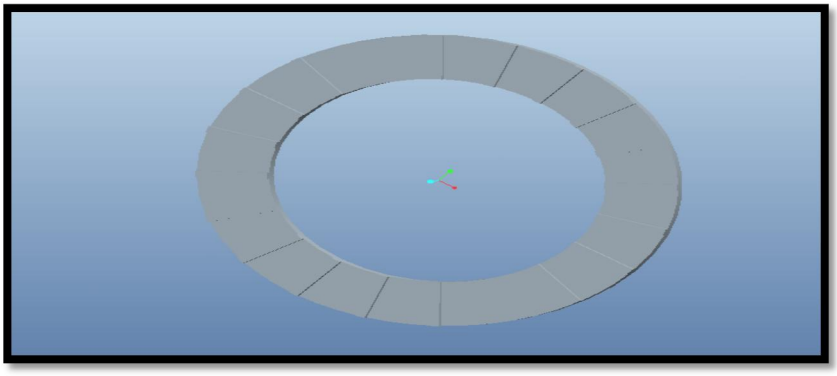
ADVANTAGES OF CREO PARAMETRIC SOFTWARE

1. Optimized for model-based enterprises
2. Increased engineer productivity
3. Better enabled concept design
4. Increased engineering capabilities
5. Increased manufacturing capabilities
6. Better simulation
7. Design capabilities for additive manufacturing

CREO parametric modules:

- Sketcher
- Part modeling
- Assembly
- Drafting

3d model



2d model

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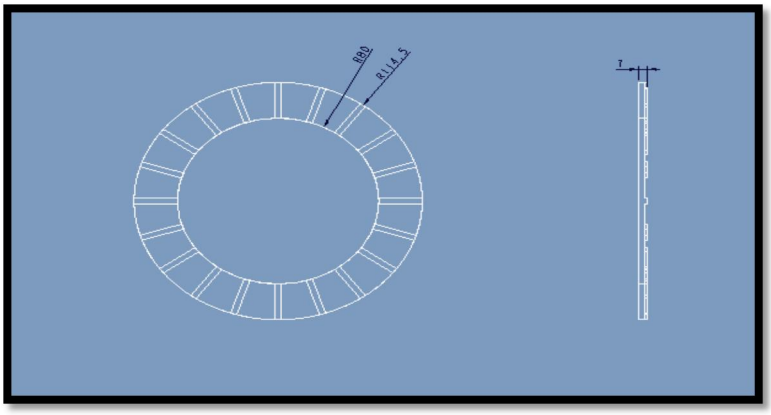


STATIC ANALYSIS OF SINGLE PLATE CLUTCH

Materials used

Steel

Young's modulus = 205000mpa

Poisson's ratio = 0.3

Density = 7850kg/mm^3

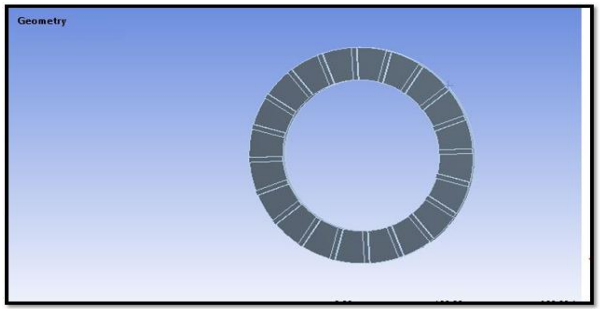
Cast iron

Young's modulus = 110000 mpa

Poisson's ratio = 0.28

Density = 7200

Import geometry



Meshing

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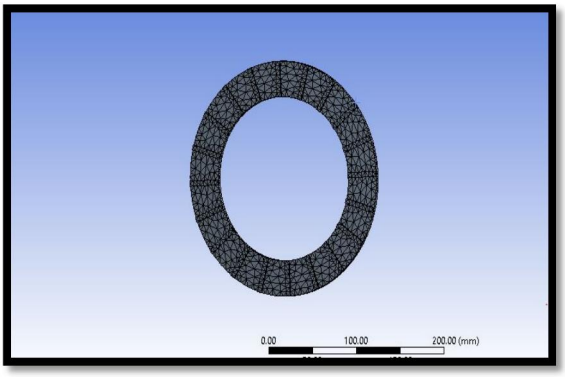
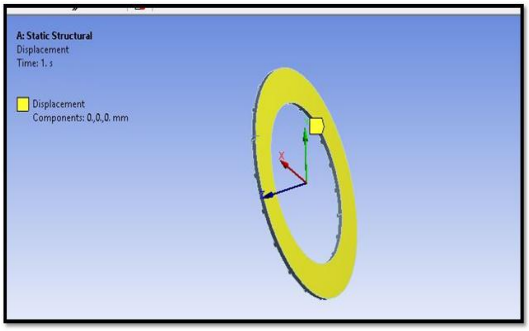
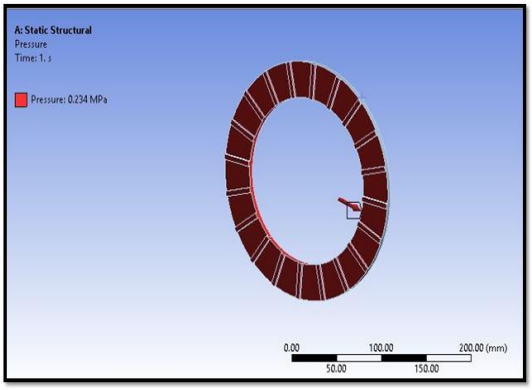


Boundary conditions





MATERIAL – STEEL

TOTAL DEFORMATION

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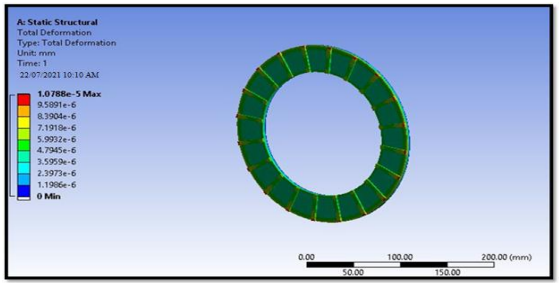
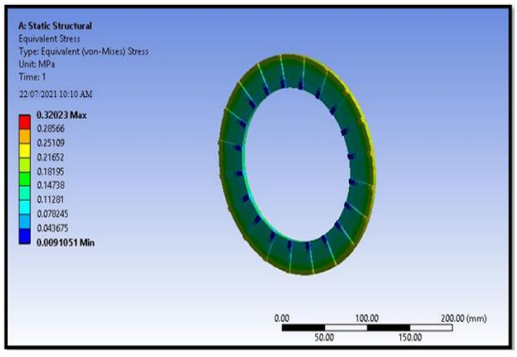
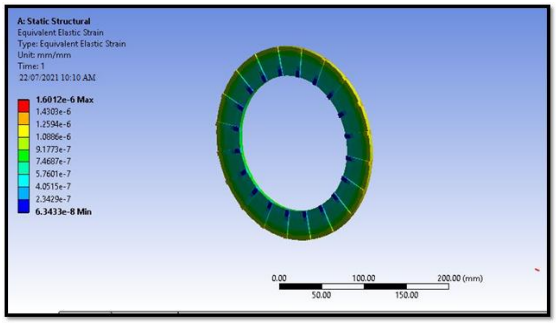


Stress



Strain



RESULTS TABELS

STATIC ANALYSIS RESULTS

MATERIAL	DEFORMATION(mm)	STRESS (N/MM^2)	STRAIN
STEEL	1.0788E-5	0.3023	1.6012E-6
CAST IRON	1.92E-5	0.31251	2.84E-6
COPPER	1.54E-5	0.32894	2.452E-6

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FATIUGE ANALYSIS RESULTS

MATERIAL	LIFE	DAMAGE	SAFTEY FACTOR
STEEL	1E10	0.1	4.3094
CAST IRON	1E10	0.1	4.4159
COPPER	1E10	0.1	4.1953

CONCLUSION

In this paper, we design a multi plate clutch by using empirical formulas. A 2D drawing is drafted for multi plate clutch from the calculations & a 3D model is created in the modeling Software CREO for Automobile Applications. Analysis done in ANSYS with different materialsStatic analysis to determine the deformation, stress and strain for the single plate clutch Modal analysis is to determine the deformations with respect to frequencies.By observing static analysis deformation is less for steel compare to cast iron and copper. By observing fatigue analysis safety factor is more for steel so we conclude that steel is better for multi plate clutch

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