

# DESIGN AND ANALYSIS OF A CLUTCH PLATE

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**Abstract** The clutch is one of the main components in automobiles. The power of engine is transmitted to the system through the clutch. If the main component fails the whole application can be damaged. The present used material for friction disc is Asbestos. In this paper composite material Kevlar 29, Gray cast iron are taken. A single plate clutch is designed and modeled using Catia V5 software. Static analysis is done on the clutch to determine stresses, strain, deformations using following materials in Ansys. Theoretical calculations are also done to determine strength, weight saving in percentage and weight reduction.

**Index Terms** – CLUTCH PLATE, STRESS, DEFORMATION, CATIA.

## I.INTRODUCTION

The driving mechanism in which the driving force and another mechanism are linking with the driven mechanism. Its opposite component is a brake, which inhibits motion .they are useful in devices so that have two rotating shafts. It is typically attached to a motor or power unit which provides output power for work to be done. In a drill, for instance, one shaft is driven by a motor, and the other drives a drill chuck. It can either be locked together and spin at the same speed or be decoupled and spin at different speeds. It is a machine member used to connect the driving shaft to a driven shaft, so that the driven shaft may be started or stopped at will, without stopping the driving shaft. Thus provides a connection between two rotating shafts. It permit a high inertia load to be stated with a small power.

### A.TYPES OF CLUTCH

1. Cone clutch.
2. Single plate clutch.
3. Multi-plate clutch.
4. Semi-centrifugal clutch.
5. Centrifugal clutch.

### B. SINGLE PLATE CLUTCH

In the single-plate clutch a single flat circular plate is attached between the inside face of the flywheel and a clamping plate which is made to attach the clutch plate by means of clamping levers operate by strong spring. The amount of pressure applied on the clamping plate can be varied by adjust pins on which the end of the clamping levers pivot. The inside face of the flywheel and a clamping plate is made to attach the clutch plate by means of clamping levers actuated spring.

### C.MATERIAL USED FOR CLUTCH PLATE:

1. Gray Cast Iron
2. Kevlar 29

### D. THE ADVANTAGES OF CLUTCH PLATE:

1. Soft engagement and smallest amount shock during the engagement.
2. Friction clutch can be engaged and disengaged.
3. Simple to operate.
4. They are able of transmitting one-sided power.
5. Friction clutch can take steps for a safety device.
6. Frequent engagement and disengagement is possible

**E. MATERIALS PROPERTIES USED FOR FRICTION PLATE:**

S.NO	MATERIAL	YOUNGS MODULUS (PA)	DENSITY (KG/M <sup>3</sup> )
1	GRAY CAST IRON	1.1e <sup>11</sup>	7200
2	KEVLAR 29	5.9e <sup>10</sup>	1440

**II. SOFTWARE****A. INRODUCTION TO CATIA**

CATIA enable the creation of 3D parts, sketches, forged or tooling part up to the definition of mechanical assemblies. The latest technology for mechanical surfacing is also provided by this software. It provides tools to complete product definition and kinematics. It provides a large range of applications for tooling design. In the case of Aerospace engineering sheet metal design offers the user combine the capabilities of generative sheet metal design and generative surface design

**B. INTRODUCTION TO ANSYS WORKBENCH**

The structural analysis including linear, nonlinear and dynamic are done in ANSYS. This product provides finite elements to model behavior and supports material models and equation solvers for a large range of mechanical design problems. It also has piezoelectric, thermal –structural and thermos electric analysis. The displacements, stresses, strains, and forces are determined by using static structural analysis. Steady loading and response conditions are used for the structure's response are assumed to vary slowly with respect to time.

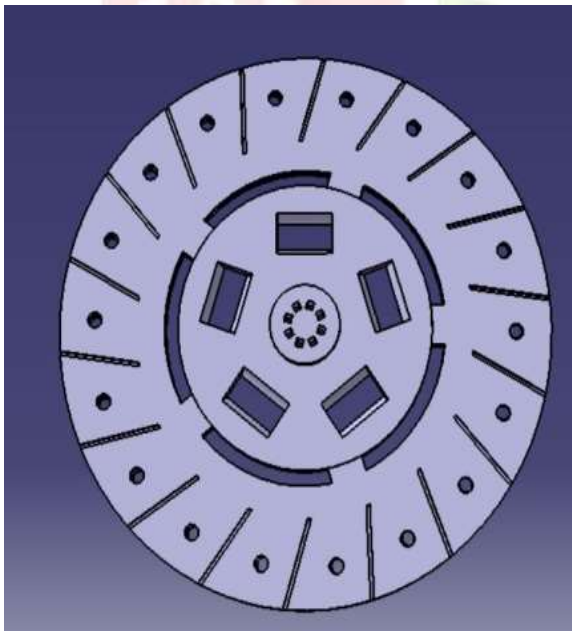
**III. DESIGN AND ANALYSIS:**

FIG 1: DESIGN OF CLUTCH PLATE

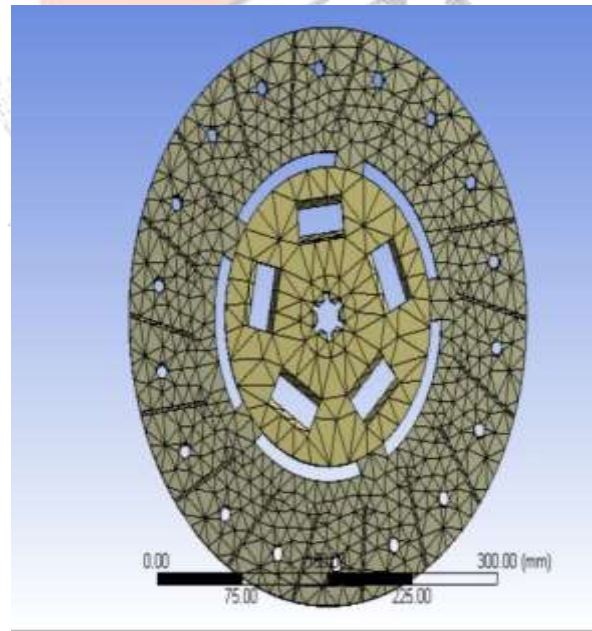


FIG 2: MESHING OF CLUTCH PLATE

**ANALYSIS OF GRAY CAST IRON:**

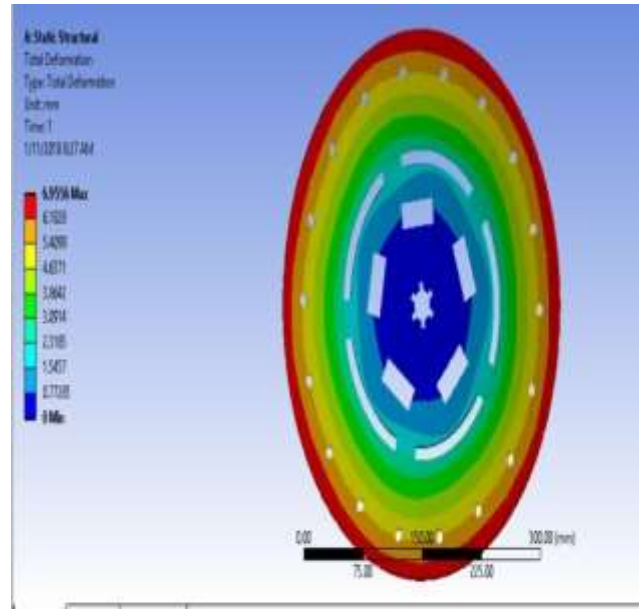
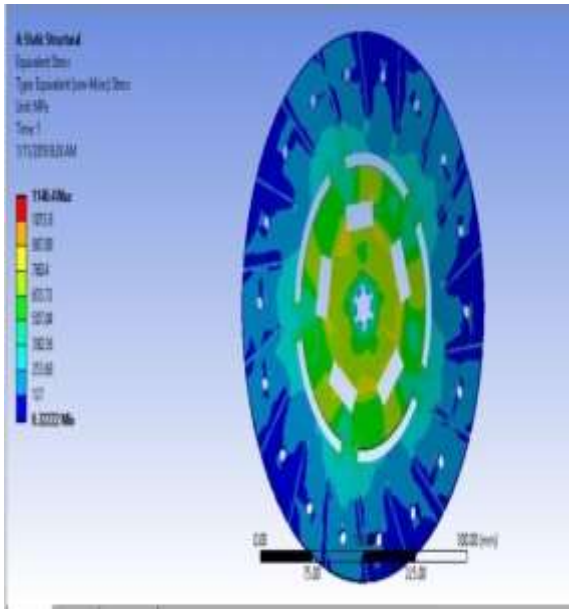


FIG 3 :STRESS ANALYSIS OF GRAY CAST IRON

FIG 4: DEFORMATION OF GRAY CAST IRON

**ANALYSIS OF KEVLAR 29 :**

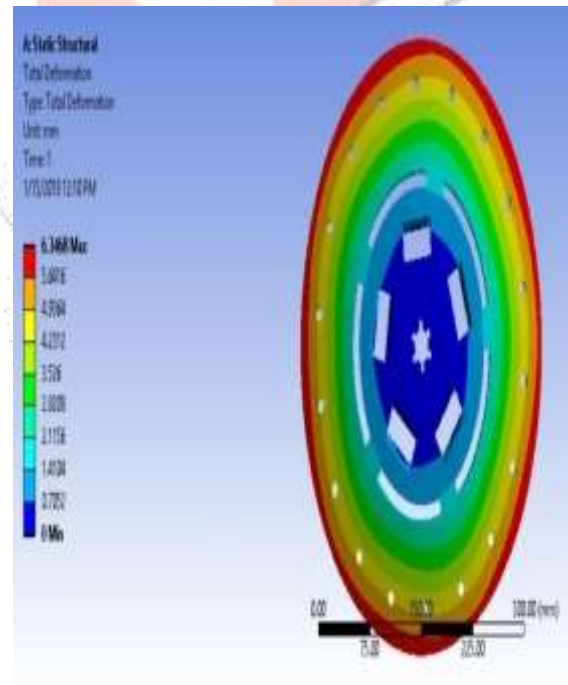
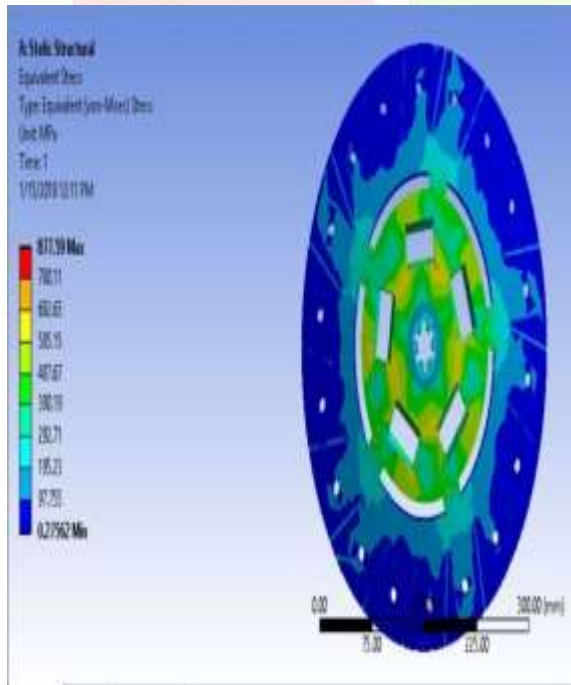


FIG 5: STRESS ANALYSIS OF KEVLAR 29

FIG 6: DEFORMATION OF KEVLAR 29

#### IV.CONCLUSION:

In this paper, a single plate clutch is modelled in 3D modelling software Catia v5 and theoretical calculations and also static analysis has done by using ANSYS Workbench 16.0. Present used material for clutch is Asbestos. In this project, it is replaced with Gray cast iron and Kevlar 29. Has been selected for friction plate and static Analysis has been done to find the total deformation, equivalent stress . by comparing the results it is clear that Kevlar 29 has less deformation than other materials, So using the materials is safe. And by comparing the Theoretical Calculations between materials, Kevlar 29 is more advantageous than other materials due to its less weight and high strength.

#### A. STRESS, DEFORMATION, STRAIN

S.NO	MATERIAL	DEFORMATION (mm)	STRESS(pa)	STRAIN
1	GRAY CAST IRON	6.9557	1140.2	0.00836
2	KEVLAR 29	6.3468	877.59	0.0099352

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