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Design and Structural Analysis of Composite Coated Clutch Plate by using Composite Materials

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Abstract:

A clutch is a mechanical device which provides for the transmission of power (and therefore usually motion) from one component (the driving member) to another (the driven member). The opposite component of the clutch is the brake. A multi plate clutch may be used when a large torque is to be transmitted. The inside discs are fastened to the driven shaft to permit axial motion. The outside discs are held by bolts and are fastened to the housing which is keyed to the driving shaft. The multi disc clutches are extensively used in motor cars, motorbikes, machine tools etc. The inside discs are usually made of steel and outside discs is usually made of bronze. The materials used for lining of friction surfaces are Asbestos, Cork, Rubber, Cast iron, Powder metal.

The aim of the project is to design a clutch plate by using empirical formulas. A 2D drawing is drafted for clutch plate from the calculations and a 3D model is created in the 3D modeling software CATIA.

We are also conducting structural analysis for above design for validating design. We are conducting analysis by varying the friction surfaces material. By extracting the result we are going to find out which material is best for the lining of friction surfaces.

Structural analysis is done for clutch plate using the properties of the three materials. Materials used for liner is carbon-carbon composites, Kevlar, Ceramic composites. Comparison is done for above materials to validate better lining material for clutch plate.

I. INTRODUCTION

Automobile friction clutch is an essential component in the process of power transmission, therefore all designers want to obtain the best possible perfor mance with comfortable condition (reduce the noise and vibration as much as possible) for the friction clutches. The vibration and noise generated during the engagement is one of the biggest obstacles faced designers; this is because there are many variables that affect on this phenomenon such as pressure distribution, coefficient of friction, materials properties, and sliding velocity …etc. For that reason, it's very important to estimate the natural frequencies of clutch disc and the corresponding modal shapes within acceptable degree of accuracy at the design stage. VinayakRanjan and M.K. Ghoshis studied the in-plane free vibration of an elastic and isotropic disk on the basis of the two-dimensional linear plane stress theory of elasticity. The boundary characteristic orthogonal polynomials are employed in the Rayleigh

Ritz method to obtain the natural frequencies and associated mode shapes. In the work, free and forced transverse vibration behavior of a spinning disc with a rigid core having discrete patches and discrete masses.

The aim of this research is to shed light on the importance of grooves in friction clutch, and the effect of these grooves on temperature field for friction material of clutch. Two kinds of grooves models presented in this paper, classic groove models (radial, circumferential and radial with circumferential together) and proposed groove models (curved grooves).

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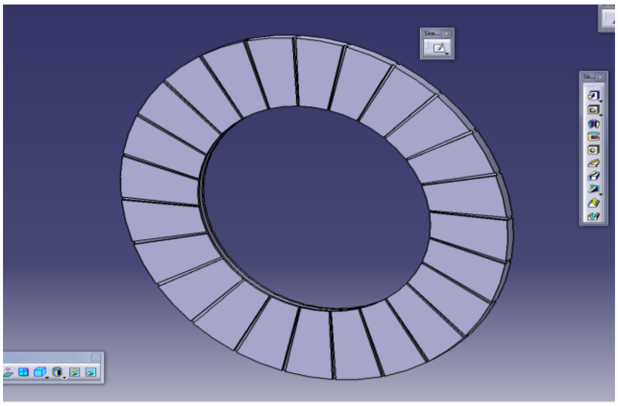
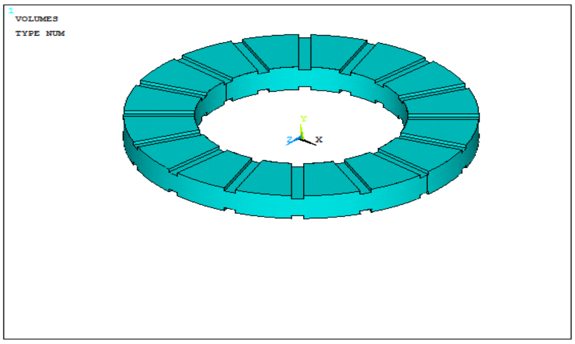
DESIGN OF THE MODEL

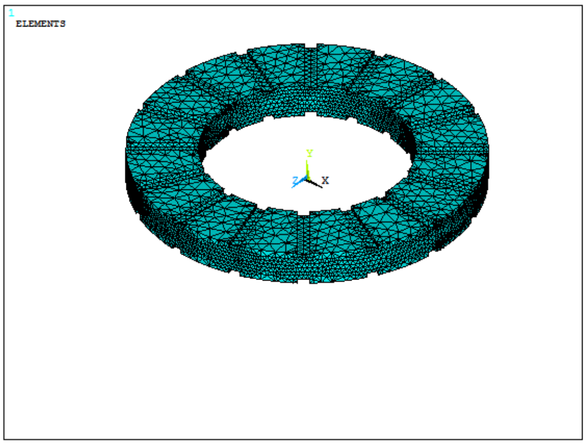


IMPORTED MODEL OF CLUTCH PLATE WITH MATERIAL CARBON-CARBON COMP OSITES

IMPORTED MODEL



MESHED MODEL



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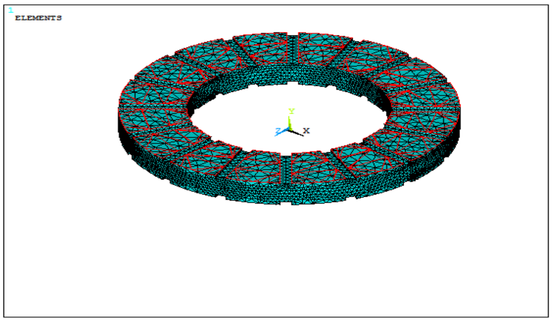
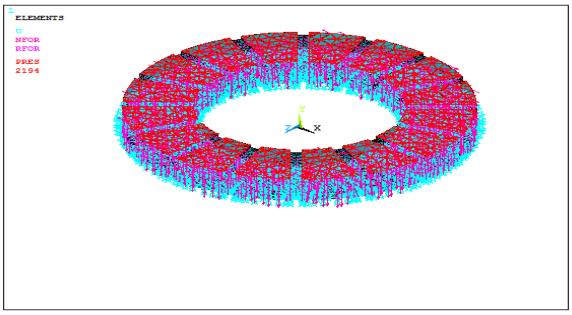
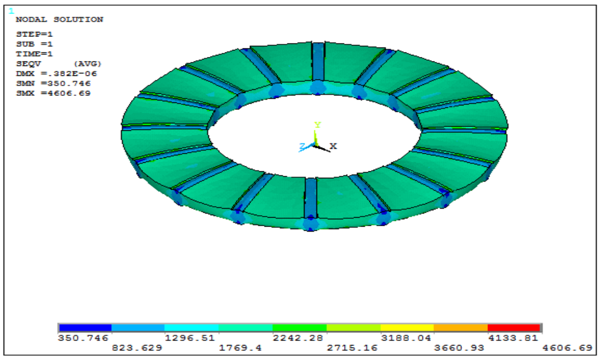


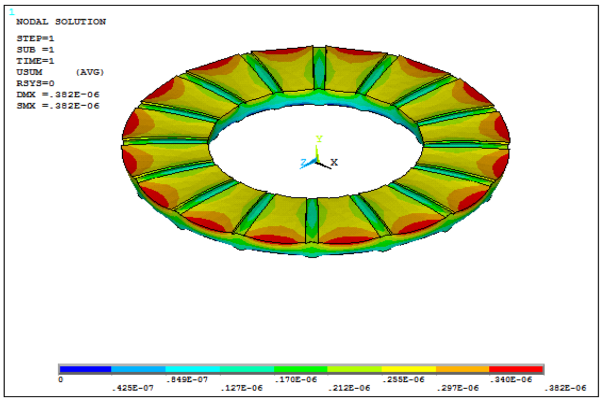
AFTER PRESSURE APPLIED



STRESS



DEFORMATION



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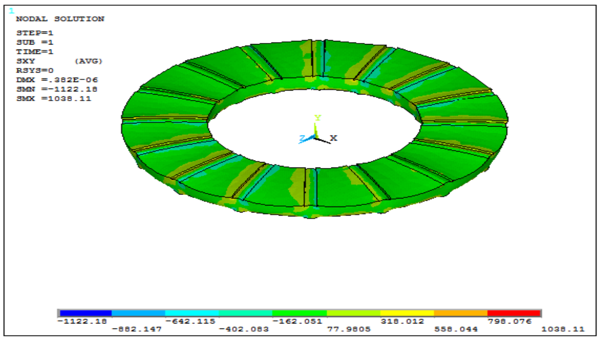
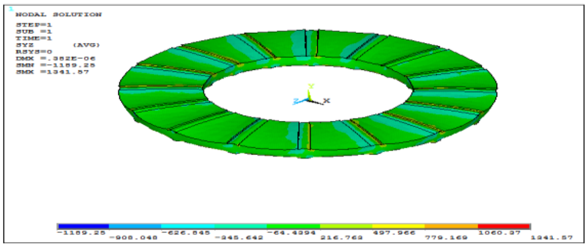
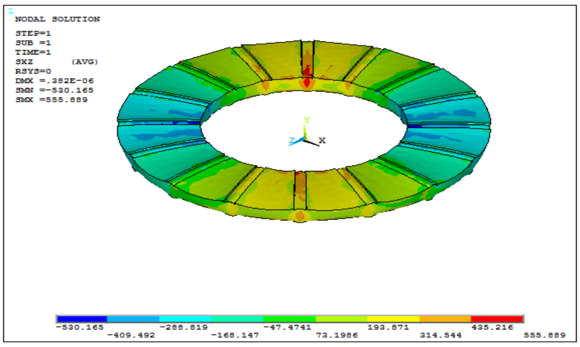
XY SHEAR STRESS



YZ SHEAR STRESS

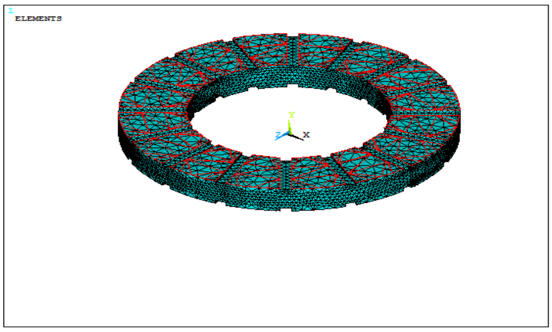


XZ SHEAR STRESS



IMPORTED MODEL OF CLUTCH PLATE WITH MATERIAL KEVLAR

INPUT DATA



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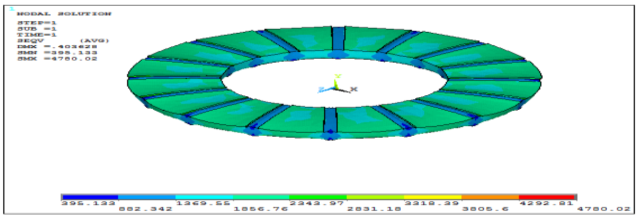

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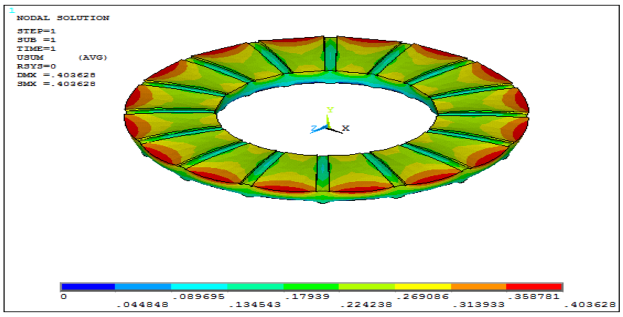
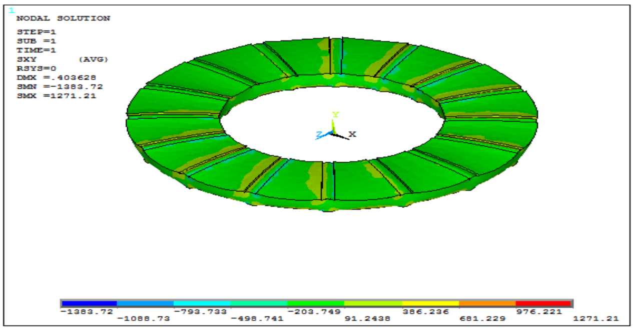
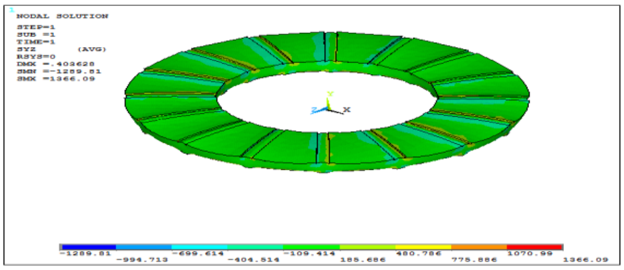


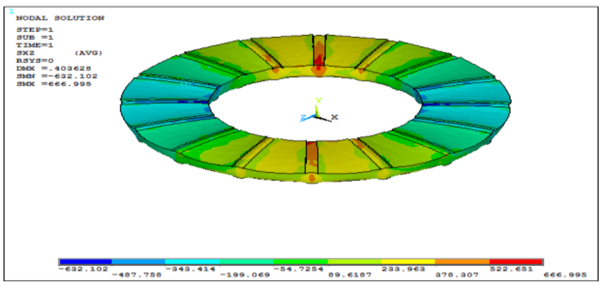
XY SHEAR STRESS



YZ SHEAR STRESS



XZ SHEAR STRESS



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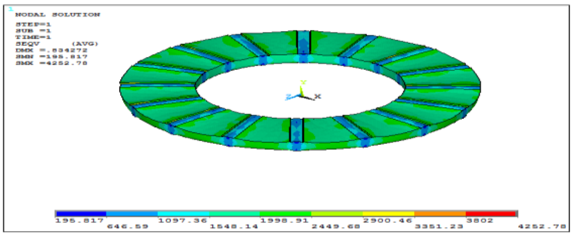
IMPORTED MODEL OF CLUTCH PLATE WITH MATERIAL CERAMIC COMPOSITE

STRESS



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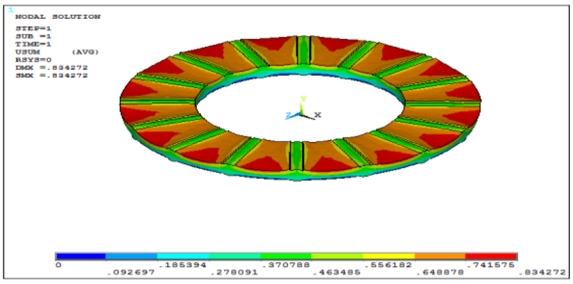
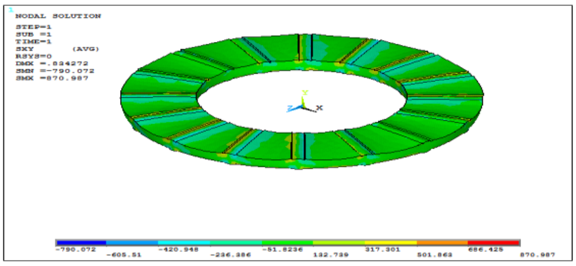
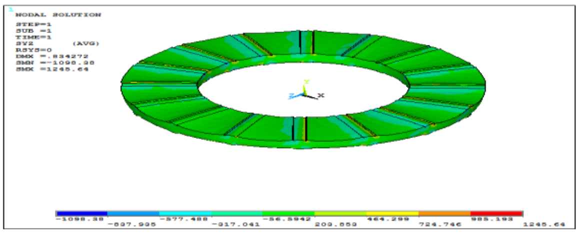


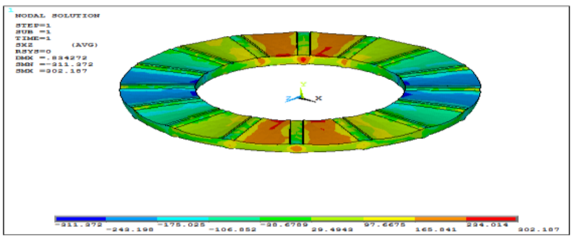
XY SHEAR STRESS



YZ SHEAR STRESS



XZ SHEAR STRESS



RESULTS TABLE

STRUCTURAL ANALYSIS RESULTS:

MATERIAL	STRESS		DEFORMATION	XY SHEAR STRESS		YZ SHEAR STRESS		XZ SHEAR STRESS	
	MIN	MAX		MIN	MAX	MIN	MAX	MIN	MAX
CARBON CARBON	350.746	4606.69	0.382E-06	-1122.18	1038.11	-1189.25	1341.57	-530.165	555.889
KEVLAR	395.133	4780.02	0.403628	-1383.72	1271.21	-1289.81	1366.09	-632.102	666.995
CERAMIC	195.817	4252.78	0.834272	-790.072	870.987	-1098.38	1245.64	-311.372	302.187

CONCLUSION

Structural analysis is conducted for validating design by varying the friction surfaces material. By extracting the result, find out the best material for the lining of friction surfaces. Here Materials used as liner is composite materials. They are carbon- carbon composites, Kevlar29 and ceramic composites. Comparison is done for above materials to validate better lining material for clutch plate

It found that the stress (4252.78N/mm2) has the lesser value for the ceramic composite lining material and also deformation (0.834272mm) has the better result than the other materials along with stress in XY, YZ & ZX directions.

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- Now I can conclude that the ceramic composite material is having the lesser stress value than compared with the other materials. So from all the above data and graphsclutchplate with ceramic composite lining material is giving better output for more life efficiency.

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STUDENT

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GUIDE 1

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