Modelling and Analysis of Single Circular Grooves Made On Dry Friction Clutches

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Abstract: *We all know that clutch is a machine member and is generally used for to engage and disengage the transmission and change the gear it connect the two shafts that is driving shaft to the driven shaft that's why if there is starting or stop the driven shaft there will be with or without the stopping of the driving shaft. So in this paper we are going to modelling and analyzed the single circular grooves which are made on the friction disc.*
And also will take the result of the torque transmission capacity which will be produce at the single circular grooves disc. Here we are going to analyze over ansys and will take the model in catiav5.

KEY WORDS: *clutch, single circular grooves, torque, lining material etc.*

1. INTRODUCTION

Clutch is a machine part which is generally used in the vehicles that is in two wheeler four wheeler vehicles but here we are introducing for the four wheeler cars clutch. In this the clutch have been situated in between the gear box and the transmission system hence connect to the driving shaft to that of the driven shaft. There are generally the clutch have been classify in between four types i.e. single plate , multiplate clutch, centrifugal clutch and cone clutch.

When there is the working of clutch take place there is a huge amount of heat dissipation take place and at that time the wear takes place and hence we choose the clutch plate like which should transfer the torque properly in the needed range and the less wear occurs at that time of transmission and the one issue will be there that at that time the heat which get occurs at that time should be transferred from the grooves made on that of the clutches hence it's also very important that the which grooves are to be on that of the clutch disc or plate . Generally there are so

many types of grooves gets discovers that is spiral grooves, spiral circular grooves and double circular grooves, sunburst grooves etc. above which we are going to know the single circular grooves details like its torque transmission capacity. By analyzing the deformation, von misses stresses and heat flux. THE STANDARD TORQUE TRANSMITTING CAPACITY OF THE CLUTCH IS 69 Nm.

2. LITERATURE SURVEY

Newcomb [1] who discovered the two typical torque-time variations were discussed and a comparison takes place when there is assumed that the torque is constant.

G. K. Gangwar, Madhulika tiwari, has research in "Modeling and Simulation in hydraulic Energy Saving System: An Overview" [12] stated that by using the flywheel technology or hydraulic accumulator the effective conservative energy can produce in the hybrid vehicle.

Shrikant V. Bhoyar, G.D. Mehta, J.P. Modak, [13] have make designed for the load lifting application Conference, 14th July 2013, Tirupati, India, ISBN: 978-81-927147-9-0 In this study, a simple transmission system consisting gearbox, clutch and engine are specially designed for lifting of load application. Stiffness and equivalent stiffness of all the three shafts have been calculated. Equivalent mass moment of inertia is also calculated. From by using this data, given by Prof. DOW, have calculated the engagement duration period for the selected transmission power system and the the dissipation of energy have been plotted during the engagement. The excitation effect of torque and damping coefficient on the amplitude of vibration is plotted for various values of excitation speeds. Results shows increment in damping coefficient and the amplitude of vibration decreases with the decrease in the excitation of torque and the vibration amplitude also be decreases.

Karanjkar A. S., Barve P. C., Adhav R. B., Pandey M. D., Prof. Londhe B. C., Prof. Bhane A. B.[9], "Modeling and Simulation of Multi-Drive Clutch (ISSN 2347-6435(Online) Volume 4, Issue 4, April 2015) they have stated in this paper the design of clutch by combining the operation of the centrifugal action in the single plate clutch system of the transmission mechanism to overcome the wearing effect when there is the transmission of power from one shaft to that of the other shaft that is from driving shaft to the driven shaft.

P.Naga Karna, Tippa Bhimasankara Rao, [11] " Analysis of Friction Clutch plate using FEA", e-ISSN: 2278-067X, p-ISSN: 2278-800X, Volume 6, Issue 2 (March 2013), PP. 81-87 they have compared the two materials like aluminum and the steel of wet clutch plates by taking the observations of the stress distribution and the temperature distribution of the clutch plate by taking the dimensions of the plate in existence and also take models in the pro-e and the analysis have been taken by using the ansys.

3. MODEL MAKING IN CATIA V5

Models of grooved friction surface are designed in CatiaV5. Design specifications:

- Inner radius of friction surface= 0.06 m o Outer radius of friction surface= 0.085 m
- Thickness of friction surface= 0.004 m
- Depth of groove cut= 0.002 m
- Inner radius of supporting plate= 0.020m
- Outer radius of supporting plate=0.0825m
- Thickness of supporting plate = 0.001 m

4. THE TWO DIMENSIONAL MODEL OF SINGULE CIRCULAR GROOVES CLUTCH PLATE

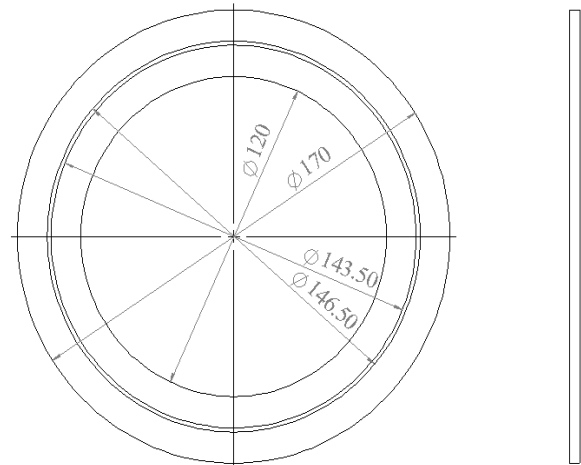Model of friction plate with Single Circular grooves is prepared in CATIA V5. The dimensions of this are as follows:

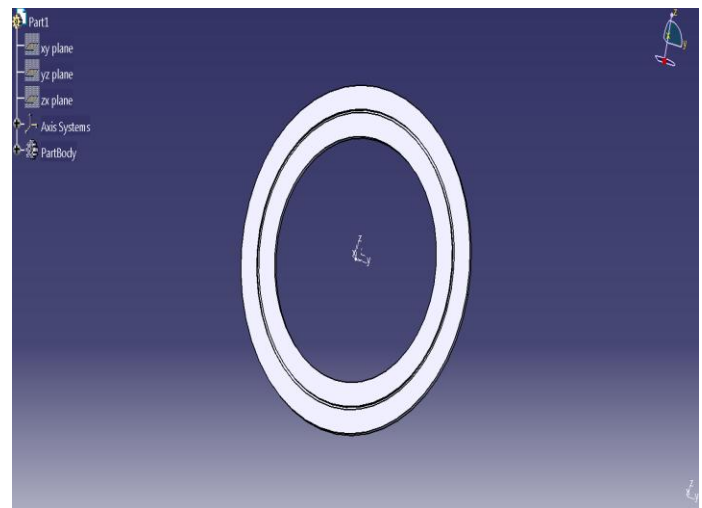Fig 1. Friction plate with Single Circular grooves

Fig 2. . Friction plate with Single Circular   grooves (In CATIA V5)

5. ANALYSIS OF SINGLE CIRCULAR GROOVES MADE ON DRY FRICTION CLUTCH PLATE

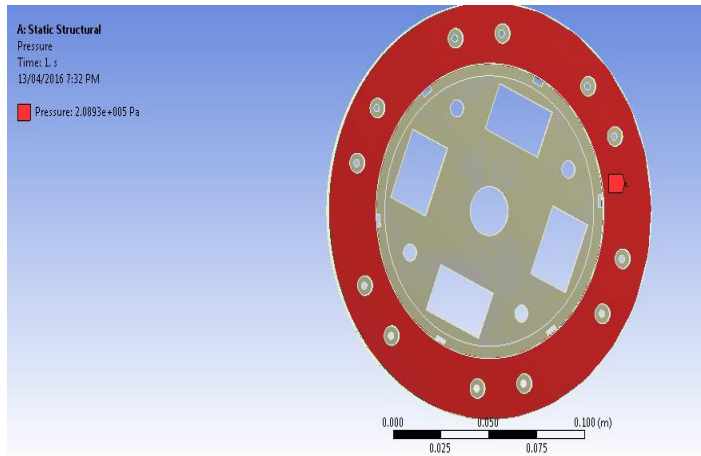### 5.1 Thermal analysis of the clutch

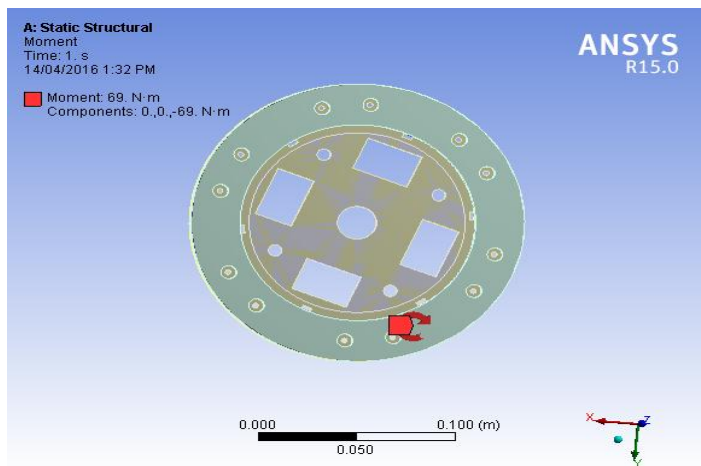Fig 3. Application of pressure on friction plate

Fig 4. Application of torque on friction plate

Similarly boundary conditions and pressure, torque is applied on different models. Then results obtained from this analysis are further compared.

6. RESULTS AND DISCUSSION

Analysis of above grooved friction surfaces are listed in the groups. This analysis has given following results:
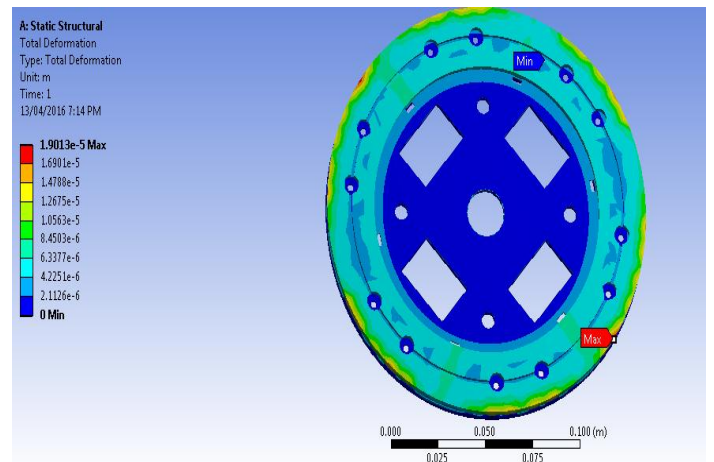
6.1 Total deformation

Fig 6. Total deformation in friction plate with Single Circular grooves

The above model has given maximum deformation as $1.9013e^{-5}$ m. The maximum deformation is on friction plate.
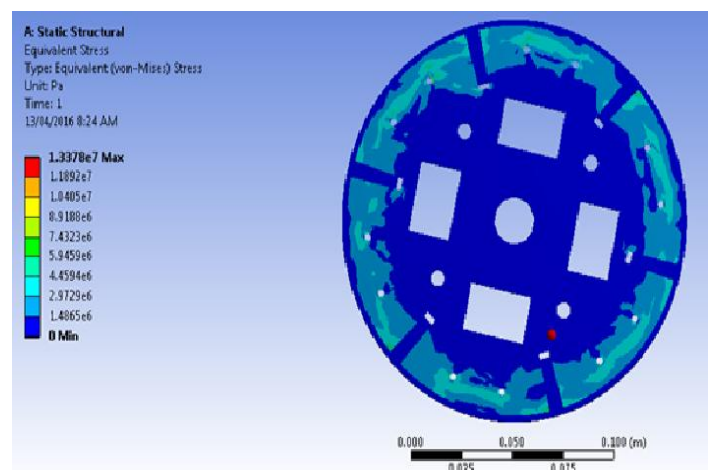
6.2 Von misses stresses

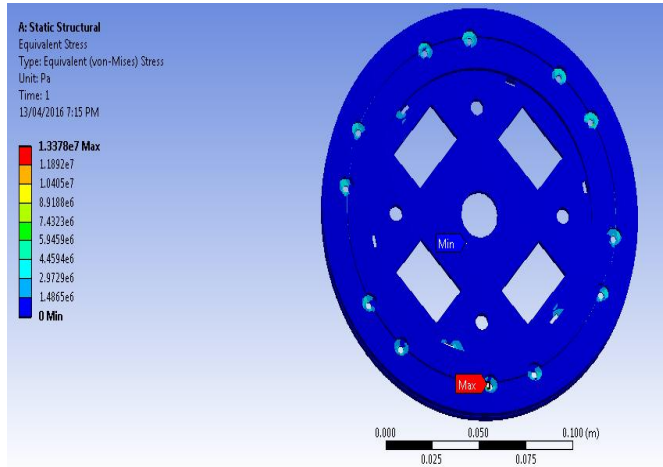Fig 7. Von-misses stresses in friction plate with Single Circular grooves

Fig 8. Von-misses stresses in friction plate with Single Circular grooves

The above model has given maximum Von-misses stresses as $1.3378e^7$ Pa. The maximum stress is on supporting plate.
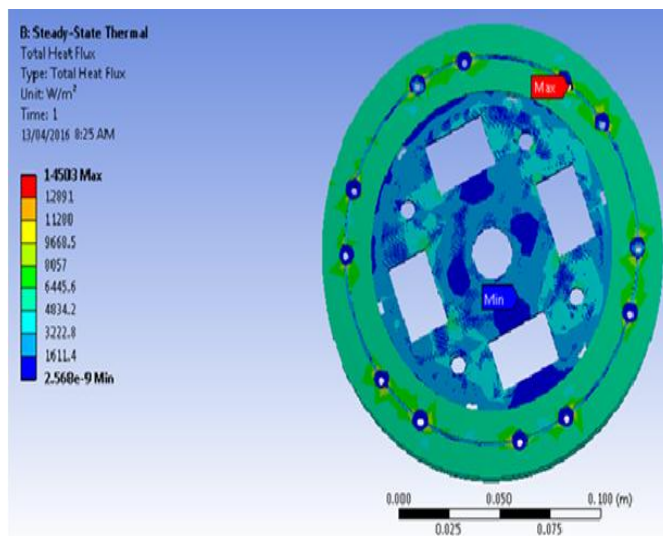

Fig 9. Heat Flux in friction plate with Single Circular grooves

The above model has given maximum Heat Flux as 14503 W/m².
The values of Total deformation, Von-misses Stress, Normal reaction force, Heat Flux can be compared as follows:

6.3 Comparison of Total deformation, von misses stress and heat flux in grooved designs

Sr. No.	Type of grooves	Von misses stress(Pa)	Deformation (m)	Heat flux (W/m²)	Normal reaction force(N)
1	Single Circular groove	$1.3378\ e^7$	$1.901\ e^{-5}$	14503	2142.5

6.4 Calculation of Torque transmitting capacity

Friction disc with Single Circular grooves
        T=2*0.2*2142.5*0.0725
        T=62.131 Nm.

7. CONCLUSION AND FUTURE SCOPE

Conclusion

From above observations, maximum torque that can be effectively transmitted with Single Circular groove pattern which is 10.43% more than that of 23° Inclined grooves. With extra cooling effort this model is better to get maximum torque transmitting capacity.

Future scope

The above results can be tested by fabricating test model which will use torque sensor to measure torque transmitting capacity of single plate dry friction clutch.

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