

Analysis of 23 Degree Inclined Grooves Made on Dry Friction Clutch

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ABSTRACT: Clutch is a machine member which is generally used to engage or disengage the driving shaft to the driven shaft with any engagement or disengagement, hence it provides an interruptible connection between these two rotating shafts. Mostly here we have used friction clutches and has transmit the torque from one shaft to another shaft at that time huge amount of energy have been induced in it and results in wear . Hence for getting the results we have done here the analysis of the 23° inclined grooves made on the dry friction clutch plate in the ANSYS by taking the reference of Maruti alto 800.

KEYWORDS: Dry friction clutches, Wear failure, 23° Inclined Grooves, Lining material.

I. INTRODUCTION

Clutch is a machine member which is generally used to engage or disengage the driving shaft to the driven shaft with any engagement or disengagement, hence it provides an interruptible connection between these two rotating shafts. A popularly known application of clutch is in automotive vehicles where it connects engine and the gear box. Here the clutch enables to crank and start the engine disengaging the transmission and change the gear to alter the torque on the wheels. Clutches are also used broadly in production machinery of all types.

Clutches are generally classified as:

- Dry friction clutches
- Single plate clutch:
- Multi plate clutch:
- Cone clutch:
- Centrifugal clutch:

II. ROLE OF CLUTCHES IN AUTOMOBILE

Clutch is a machine member which is located between a vehicle engine and its transmission and provides mechanical coupling in between the engine and the input shaft of the transmission. Clutch system comprise of flywheel, clutch disc plate and friction frictional material, diaphragm spring , clutch cover , pressure plate and the linkage necessary to operate the clutch. The clutch gradually engage the transmission and allow certain amount of slippage between the flywheel and the input shaft of transmission. However, the slipping clutch mechanism generates heat energy due to friction between flywheel and the clutch disc. Excessive frictional heat is generated at high sliding velocity which lead to causes thermo-mechanical problems because of high temperature rise the clutch disc surface such as thermal deformations and thermo-elastic instability occurs which lead to thermal cracks, wear and other mode of failure of the clutch disc component.

w= Normal reaction force

r= Effective radius of clutch plate

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Hence it results in reducing torque transmitted. It aims to do analysis for torque transmitting capacity of various groove shaped clutch plates.

III. LITERATURE SURVEY

Oday I. Abdullah, Josef Schlattmann, Emir Pireci, [1] "Optimization of Shape and Design Parameters of the Rigid Clutch Disc Using FEM", FME Transactions (2013) 41, 317-324 317.

The numerical results show that the stresses and vibration characteristics of rigid clutch disc should control by adjustment of design parameters. They show as well that the suggested model should improves the response of the friction clutch plate as consider. The ANSYS/WORKBENCH14 and SolidWorks 2012 have been used to perform the numerical calculation.

P.Naga Karna, Tippa Bhimasankara Rao, [11] e-ISSN: 2278-067X, p-ISSN: 2278-800X, Volume 6, Issue 2 (March 2013), PP. 81-87

The object of the present work is to observe the stress distribution and by changing the material the temperature distribution of clutch plate takes place. And for that we are taken one existing clutch plate dimensions with the help of Pro-e have modelled after the analysis have done by using Ansys. Here we have done two types of analyses on clutch plate likely static analysis and the thermal analysis. By performing these analyses we got the results namel temperature distribution and stress distribution and. And at last we have compare the results steel and aluminum wet clutch plates.

G. K. Gangwar, Madhulika tiwari, has research in "Modeling And Simulation in hydraulic Energy Saving System: An Overview",[12] International Journal Of Research In Aeronautical And Mechanical Engineering, Vol.1 Issue.8, December 2013, Pgs: 10-19

Based on the systematic of the well-known closed circuit mobile transmissions, a new hydrostatic transmission system has been applied in power hydraulics, is introduced in this paper. To improve efficiency there are multiple ways for conserving the energy of the vehicle. The use of flywheel technology or hydraulic accumulator both, are an effective means of conserving energy in hybrid vehicles. This paper presents the introduction, mathematical modeling and review over mechanics and engineering of the flywheel, and will clarify how flywheel and hydraulic accumulator of energy storage work and how they should applied to hybrid vehicles.

Shrikant V. Bhoyar, G.D. Mehta, J.P. Modak, [13] "Dynamic Analysis Of Single Plate Friction Clutch", Proceedings of AECE-IRAJ International 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, the 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. The effect of excitation 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 decrease in excitation torque, vibration amplitude decreases.

Virendra kumar patel, Gopal Sahu, Prakash Kumar Sen, Ritesh Sharma, Shailendra Bohidar, [14] Reviews over the Wear Analysis of the Different Types of Clutch Materials, International Journal of Research in Advent Technology, Vol.3, No.11, November 2015, E-ISSN: 2321-9637

IV. SOME GENERAL STEPS TO FOLLOW THE FINITE ELEMENT ANALYSIS

A) PRE-PROCESSING

The pre-processing step is, quite generally, described and define the model and including

- Firstly define the geometric domain of the problem.
- Define the element type(s) to be used.

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- Define the required material property of the element.
- Define accurate geometric properties of the element. i.e (length, area, and the like).
- Define the element connectivity's (mesh the model).
- Define the physical constraints (boundary conditions).
- Define the exact loading.
- The preprocessing (model definition) step is critical

B) SOLUTION

During this phase, assemble the finite element software by governing algebraic equations in matrix form and computes all the primary field variable(s) having unknown values. The computed values are then used by back substitution to compute derived variables, and the additional reaction forces, element stresses, and heat flow. As it is not uncommon for the finite element model which represents tens of thousands of equations, special solution techniques are used to reduce requirements of data storage and the computational time. Hence for static, linear problems, a wave front solver, based on Gauss elimination is commonly used.

C) POST PROCESSING

Analysis and evaluation of the solution results is referred to as postprocessing. Postprocessor software which contains sophisticated routines have been used for sorting, printing, and plotting selected results from solution. Examples of operation that should be accomplished have includes as follows:-

- Sort stresses induced over element in order of magnitude.
- Check all equilibrium equations.
- Calculate factors of safety.
- Plot deformed structural shape
- Animate dynamic behavior of the model.
- Form the color-coded temperature plots.
- While solution data can be manipulated many ways in postprocessing, the most important method is to apply sound engineering judgment in determining whether the solution results are physically reasonable.

Analysis with 23o Inclined grooves:

- Structural Analysis
- Meshed model

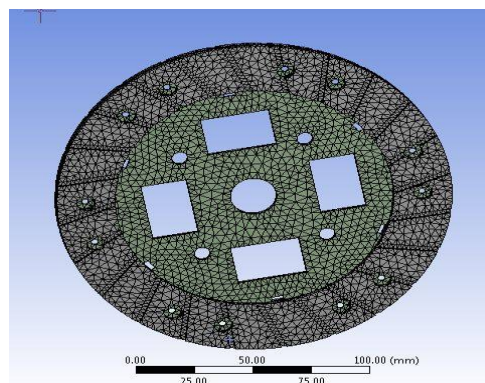


Fig: Meshed model of 23o inclined grooves

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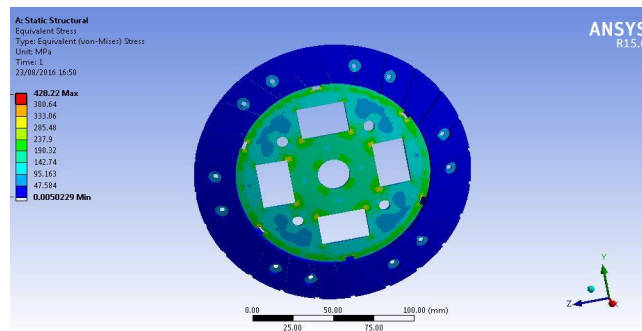
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No. of nodes: 80569

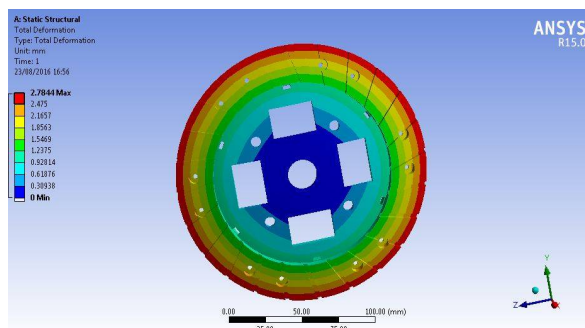
No. of elements: 39879

Von-misses stresses:



Stress value for clutch is 420.2 N/mm² which is below the critical value. Hence, design is safe.

Deformation:



From fig, deformation for clutch is 2.78 mm.

Result

23° Inclined grooves made on the dry friction clutch have been safe to use we can confirm by taking the output of the analysis parts

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