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RESEARCH ARTICLE

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FEM ANALYSIS ON WET MULTI-PLATE CLUTCH BY VARYING FRITION LINING MATERIALS FOR IMPROVED MECHANICAL PROPERTIES

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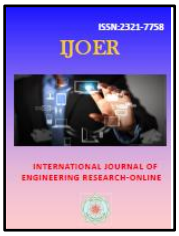

ABSTRACT

In this present paper, we design Wet clutch by Computational Modeling and 2-D drawing's are designed for ltiplate clutch from computational calculations.3D model model is created in the CATIA modeling software Structural analysis is going to perform for multi plate clutch using the properties of the two materials. Materials used for liner is Cork and Coconut coir+egg shell composite Material. Comparison is done for above all materials to validate better lining material for multi plate clutch under the different load conditions while changing the gears. Analysis is done in ANSYS software. Solid works is medium 3D Design Software featuring industry-leading productivity tools that promote best practices in design. ANSYS is general-purpose finite element analysis (FEA) software package. Finite Element Analysis is a numerical pieces (of user-designated size) called elements.

Keywords— Ansys, CATIA, Copper, Cork, SF00, SF-BU, Wet-Clutch plate, Vonmises stress, Vonmises strain, Total Deformation.

I. INTRODUCTION

It is an instrument for transmitting pivot, which can be locked in and withdrew. Grasps are valuable in gadgets that have two turning shafts. In these gadgets, one pole is commonly determined by an engine or pulley, and the other shaft. drives another gadget. Give us a chance to take an occurrence where one pole is driven by an engine and alternate drives a drill toss. The grip associate the two poles so they can either be bolted together and twist at the same rate (drew in), or be decoupled and turn at diverse paces

A. Friction Clutches: The contact friction clutch is an imperative part of any car machine. It is a connection in the middle of motor and transmission framework which directs power, in type of torque, from motor to the apparatus gathering At the point when vehicle is begun from halt grasp is locked in to exchange torque to the transmission; and when vehicle is in movement grip is initially separated of the drive to consider rigging determination and afterward again connected with easily to control the vehicle.

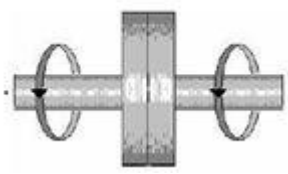

Fig.1.Engaged position of Wet-Clutch Plate

II. MATERIAL SELECTION FOR MULTI-PLATE CLUTCH

The materials utilized for the covering of grating surface of a grip called rubbing material f grinding coating materials, Qualities of the grating covering are as taking as follows:

1. It could have a high and uniform coefficient of grating under working conditions

2. It could not be influenced by dampness and oil
3. It have to be able to withstand high temperature brought about because of slipping
4. It could to have high imperviousness to wear impacts, for example, scoring, irking, and removal.
5. It could to have less push and strains.
6. It should to with stand load with less aggregate displacement.
7. It has to support of erosion properties amid whole living up to expectations life.

TABLE I: Material Properties

S.No	Properties	Young's Modulus (Mpa)	Poisson's Ratio	Density (kg/m^3)
1	Cork	32	0.25	180
2	Coconut coir and egg shell Composite	37.5	0.2857	363

III. MODELING OF WET CLUTCH

CATIA is software which is used for creation and modifications of the objects. In CATIA and design and modeling feature is available. Design means the process of creating a new object or modifying the existing one. Drafting means the representation or idea of the object. Modeling means converting 2D to 3D.

This is most progressive geometric demonstrating in three measurements. This regularly utilizes strong geometry shapes called picture to build the article. Another element of the CATIA framework is shading design capacity. By method for shading, it is conceivable to show more data on the representation screen hued pictures help to illuminate parts is a gathering or highlight measurements or host of different purposes.

By utilizing the basic capacities of the product as to the single information source standard, it gives a rich arrangement of apparatuses in the assembling environment as tooling plan and recreated CNC machining and yield. Tooling choices spread forte instruments for embellishment, pass on throwing and dynamic tooling outline.

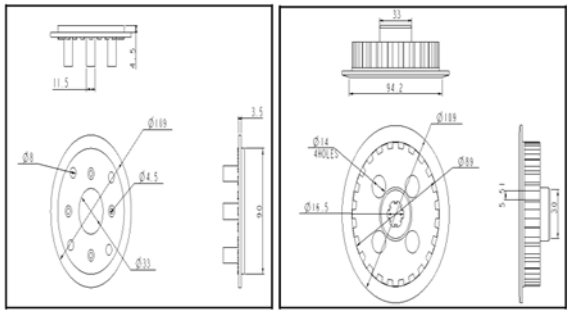

Fig.2. 2-D representation of Base-Part and Double plate.

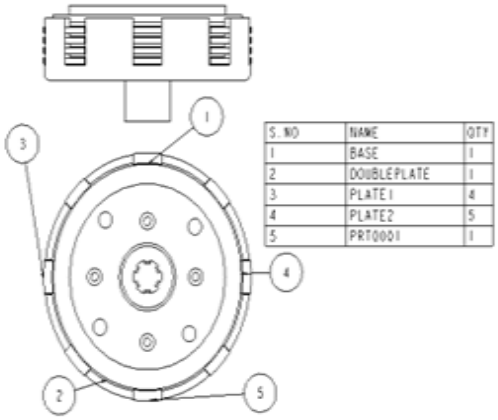

Fig.3.2-D representation of Friction-Plate and Assembly of Clutch.

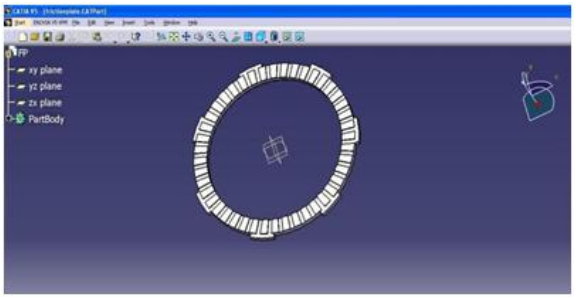

Fig.4. 3-D representation of Friction-Plate of Wet Clutch Plate.

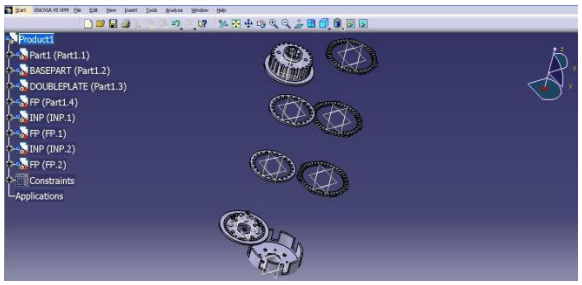

Fig.5.3-D representation of Exploded View of Wet Multi-plate Clutch.

IV. COMPUTATIONAL MODELLING

1. Power produced in Bike = 8500 rpm
2. Twisting Moment = 18.55 N-m @ 7000rpm
3. Co-efficent of friction in between the friction plates,μ = 0.3
4. .Operating temperature in between plates°C = 150 – 250
5. Maximum pressureapplied N/mm2 = 0.4
6. r1and r2 outer and inner radius of friction faces r1 =61.5mm and r2 =56.5 mm
7. Average Uniform Pressure=0.0706Mpa.
8. Volume of the pipe = 2.48×10-5 m3

V. FINITE ELEMENT ANALYSIS

Finite Element Analysis was initially produced for utilization in the aviation and atomic commercial enterprises where the security of the structures is discriminating. Today, the development in use of the strategy is straightforwardly owing to the quick advances in PC innovation lately. Accordingly, business Finite Element bundles exist that are fit for tackling the most advanced issues, not simply in Structural Analysis. In any case, for an extensive variety of utilizations, for example, relentless state and transient temperature appropriations, liquid stream reproductions furthermore recreation of assembling procedures, for example, Injection Molding and Metal framing. The finite element method is a powerful tool to obtain the numerical solution of wide range of engineering problems. The method is general enough to handle any complex shape or geometry, for any material under different boundary and loading conditions.

A. Advantages of FEM: The properties of each element are evaluated separately, so an obvious advantage is that we can incorporate different material properties for each element. Thus almost any degree of non-homogeneity can be included. There is no restriction on to the shape of medium; hence arbitrary and irregular shapes cause no difficulty like all numerical approximations FEM is based on the concept of description. Nevertheless as either the variations or residual approach, the technology recognizes the multidimensional continuous but also requires no separate interpolation process to extend the approximate solution to every point with the continuum.

B. Limitations of FEM: FEM reached high level of development as solution technology; however the method yields realistic results only if coefficient or material parameters that describe basic phenomena are available.

The most tedious aspects of use of FEM are basic process of sub-dividing the continuum of generating error free input data for computer.

C. Applications of FEM: Referring to temperature or heat flux distribution in the case of heat transfer problem.

Referring to Eigen value problems in solid mechanics or structural problem, natural frequencies, buckling loads and mode shapes are found, stability of laminar flows is found if it is a fluid mechanics problem and resonance characteristics are obtained if it is an electrical circuit problem, while for the propagation or transient problem, the response of the body under time varying force is found in the area of solid mechanics.

D. Structural Analysis: This analysis is used to perform to find Structural parameters such as Stresses, Strains, Deformation, Bending Moment and Shear stress. Structural analysis is probably the most common application of the finite element method as it implies bridges and buildings, naval, aeronautical, and mechanical structures such as ship hulls, aircraft bodies, and machine housings, as well as mechanical components such as pistons, machine parts, and tools.

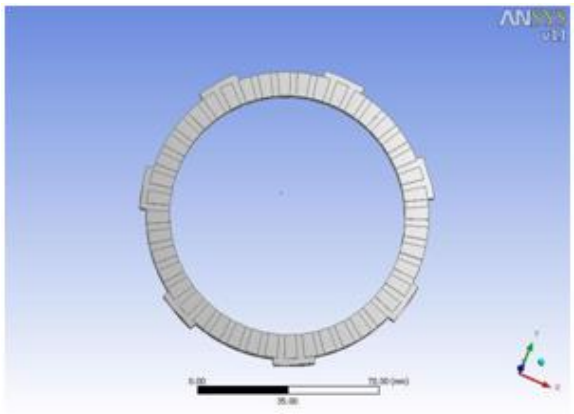

Fig.6.Clutch plate is imported into ANSYS-WORKBENCH.

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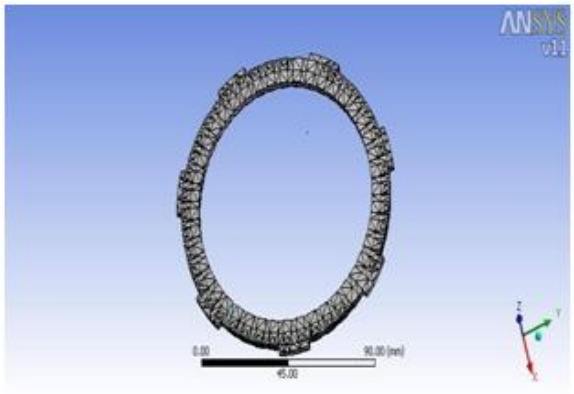

Fig.7. Meshing of Clutch plate in ANSYS-WORKBENCH.

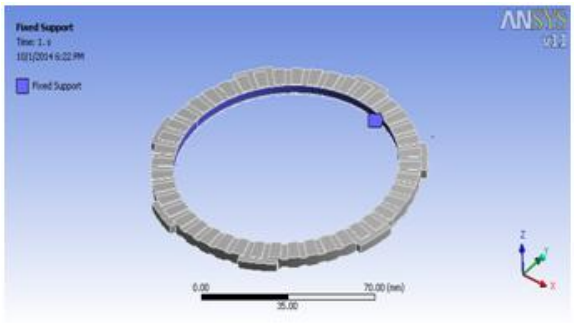

Fig.8. Boundary Condition's applied to Clutch plate

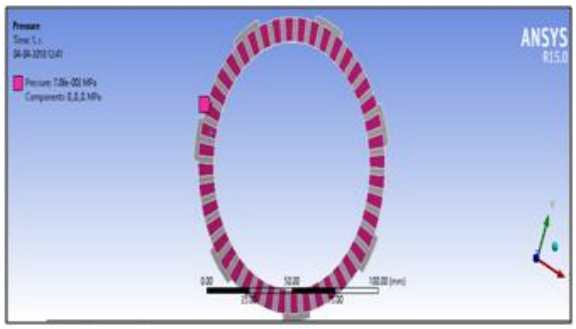

Fig.9. Loads applied on Wet-Multi plate clutch.

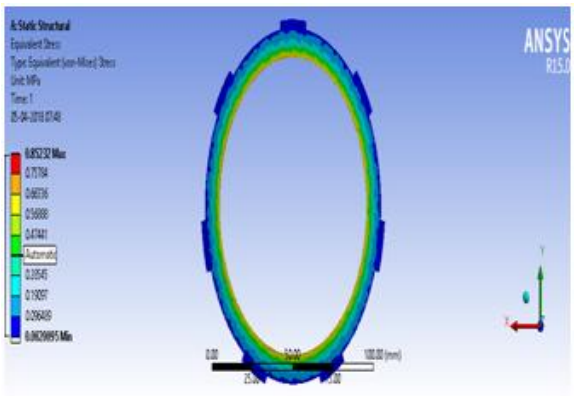

Fig.10. Vonmises stress acting on Cork Clutch plate.

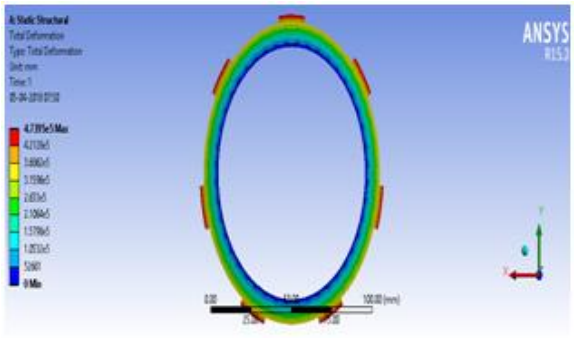

Fig.11. Total Deformation acting on Cork Clutch plate.

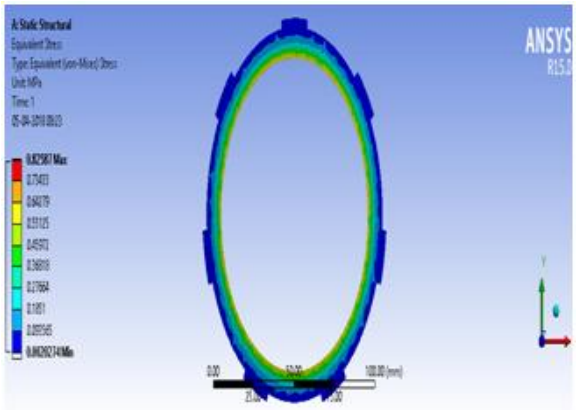

Fig.12. Vonmises stress acting on Coconut soir+ egg shell Clutch plate.

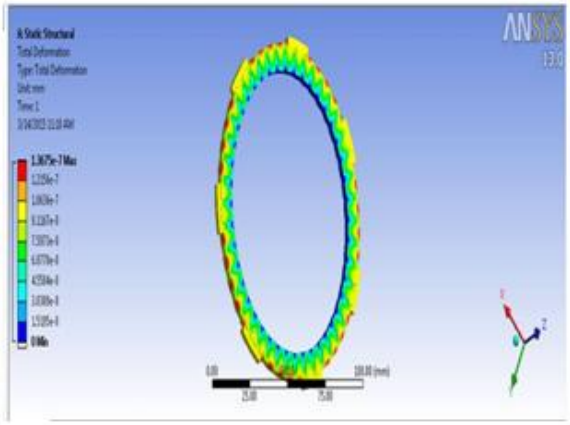

Fig.13. Total deformation acting Coconut coir+ egg shell Clutch plate

VI. RESULTS & DISCUSSIONS

TABLE III: Results Obtained From Structural Analysis

Results	Ranges	Materials Used	
		Cork	Coconut Coir & Egg Shell
Vonmises Stress (Mpa)	Maximum	0.85232	0.82587
	Minimum	0.0020095	0.0020274
Vonmises Strain	Maximum	31074	25771
	Minimum	167.52	142.08
Total Deformation (mm)		$4.7395e^{-3}$	$3.9834e^{-3}$
Directional Deformation	Maximum	90993	76622
	Minimum	-90986	-76514

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E. Graphs

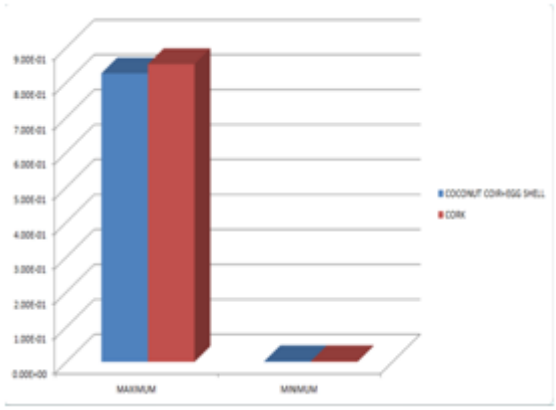

Fig. 14. Von-Mises Stress for Cork Vs Coconut coir

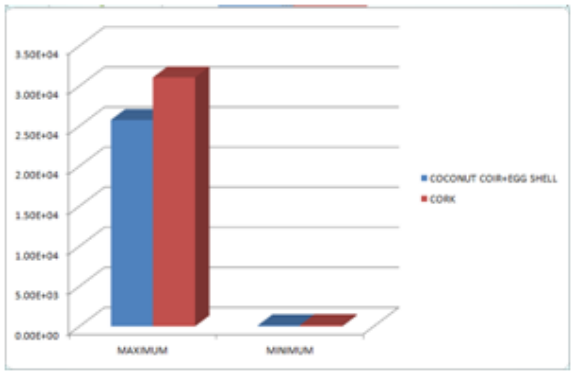

Fig15. Von-Mises Strain for Cork Vs Coconut coir

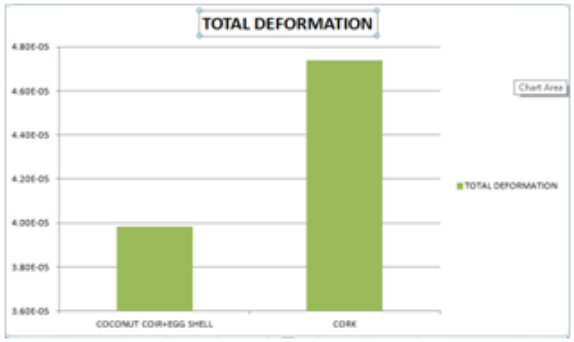

Fig16. Total Deformation for Cork Vs Coconut coir

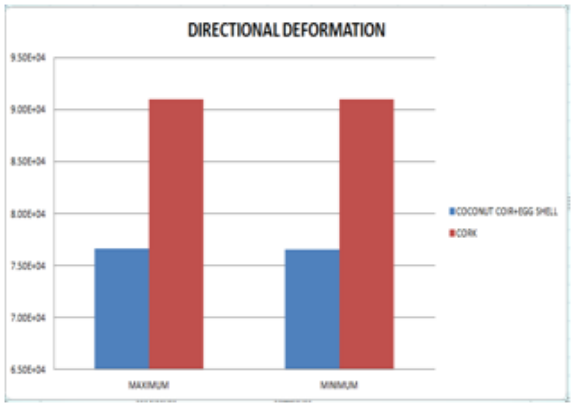

Fig17. Directional Deformation for Cork Vs Coconut coir

VII. CONCLUSION

Computational configuration demonstrating and Structural, Thermal examination is done on the grating plates to check the quality & temperature circulation of distinctive Friction materials, for Cork , Coconut powder and egg shell Composite materials. By watching the investigation results comes about, the burdens created on the contact plate are short of what its yield quality such that according to out examination outline is protected.

The Vonmises stress for Coconut coir+egg shell composite material liner is 0.82587Mpa and cork material is 0.85232Mpa which is reduced by 0.03103% total deformation for coconut coir+egg shell composite material is 3.9834e-5 and for cork material is 4.7395e-5 coconut coir+egg shell composite material total deformation is decreased by 0.1898%.

Hence we infer that for multi plate grips utilizing Coconut coir+ egg shell composite material as erosion material Strength is Improved.

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