

Experimental Evaluation and Fabrication of Composite Made Traction Gear

A. Prashanth, P.Shiva Kumar

Abstract:- Apparatus is a toothed wheel that works with others to modify the connection between the speed of a driving component and the speed of the determined parts. Outfitted gadgets can change the speed, torque, and course of a power source. The most well-known circumstance is for a rigging to work with another apparatus. This paper displays a point by point and manufacture of a high quality and minimal effort Traction equip. First The Traction outfit is demonstrated in "CATIA V5" and imported to "ANSYS" for auxiliary examination and modular investigation to decide the characteristic frequencies and mode shapes. Examination is finished by the diverse materials for gears like Cast press, carbon steel, and composite materials like Aluminum Silicon carbide results are looked at as far as possible underlined on the near execution of Traction outfit having distinctive load conditions by deciding the mistakes produced and auxiliary pressure created in the Traction design for stack conditions Using ANSYS and furthermore assess the which one is better appropriate material and manufacture utilizing that material Traction adapt is withstand and give better execution because of impacts.

Keywords: footing gear plan; auxiliary investigation; display examination; cast press; carbon steel; Aluminum Silicon carbide; ansys;

I. INTRODUCTION

Rigging is a basic segment in many of the machine parts; its implementation differs from little outfitted engine to a huge entangled aviation embellishments. Human has been in a commonplace pertaining to the possibility that the continuous twisting of either metal or wooden pieces in the forward and backward direction with an elevated abundance could burst it. He also found that the rehashed pressure can create crack within the versatile point of confinement of material which lies inside it. The exhaustion investigation for structural outlining depends on the approach which has been advancing in the course of the most recent 100 years or something like that. The simple first weakness investigation has been finished by a German mining engineer named, W.A.S. Albert who performed numerous continued stacking trials and tests on press chains. Exhaustion is the most essential disappointment mode to be considered in a mechanical outline.

Exhaustion is a gradual process of constant restricted perpetual auxiliary change showing up in materials which are subjected to various fluctuating pressure conditions. On the off chance that as far as possible does not surpass as far as possible, the body will recover its unique state. Creator ought to have a decent information of explanatory and

experimental systems to get compelling outcomes in turning away disappointment. Mechanical disappointment is watched fundamentally because of exhaustion configuration in this way weakness turns into an undeniable plan, thought for some structure, for example, flying machine, rail autos, car suspension, Vehicle edge and extensions In ordinary conditions, contact weariness is a standout amongst the most widely recognized discontent modes, especially for equipment with tooth surfaces. Rigging of tooth during the process of surface mating with one another causes glue wear for the extent of the life of apparatus drive.

1.1 Dimension Specifications

Riggings mate with one another through the surface of the teeth with unmistakable geometry. Tooth Pitch is the measure of the tooth surface which can be designated indifferently as below.

- Diametrical pitch or (DP) as denoted is the proportion of the quantity of teeth and the pitch breadth of the specific machine part. Therefore, a higher DP along these lines shows better tooth dispersing. It is effectively computed by the equation $DP = (N+2) \div OD$, where N is denoted as the quantity of teeth, and OD represents the circumferential estimation.
- Round pitch (CP) is defined to be an intermediate value that lies between the points of separation from one tooth focal point to the neighboring tooth focal point. It can be estimated by the equation $CP = \Pi \div DP$.
- Module (M) is an ordinary apparatus train and is an estimated from the size of the tooth and teeth number of the rigging. Riggings are usually designated in inches and they acquire 'English module' to forestall perplexity. $M = OD \div N$
- Weight edge is the edge at which the tooth drive activity happens, or the edge which lies along the line of force between the cross section of a specific tooth and the digression towards the pitch hover which is at the purpose of work. Average weight edges are 14.5° or 20° .

II. LITERATURE REVIEW

V. Siva Prasad^[1] in his paper substantiates the entire plan and examination of footing rigging and has clearly proposed to substitute the metallic Gear apparatuses installed in a sugarcane juice machine with the polymer apparatuses in order to lessen the weight and space of commotion. A simulated model of footing gear was created with the PRO-E Software; Further, the created Model was foreign in

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ANSYS version 10.0 for investigation by inducing it to an ordinary loading condition. The principle motivation behind his paper is the examination of the distinctive polymers specifically nylons, polycarbonates and their corresponding practical reliability checked with the corresponding mating metallic material rigging like as cast or mould press. Finishing up the investigation utilizing the FEA philosophy, it has been demonstrated that the composite riggings, if all around planned and broke down, will give the valuable properties like as a minimal effort, commotion, Weight, vibration and play out its task like the metallic apparatuses. In view of the static investigation Nylon intend are appropriate for the utilization of sugarcane juice machinery under a constrained loading condition in examination with casted press goad gears.

Vivek Karaveer^[2], in his paper exhibits the analysis of pressure in mating teeth in the gear of the footing apparatus to discover greatest contact worry in the rigging tooth gear machinery. The outcome obtained from a limited component analysis got contrasted and the hypothetical Hertz condition got esteemed. The footing machinery gears are displayed and amassed in ANSYS DESIGN MODELER software and the stress examination of footing gear tooth is finished by use of the ANSYS 14.5 programming. It has also been discovered that the consequences from both Hertz condition along with Finite Element Analysis were practically identical. From his distortion example of steel and dim cast press, it could be reasoned that the distinction in between the extreme estimations of steel and CI adapt misshaping is less comparatively.

Maheeb Vohra^[3] in his publication, has explored the features of Metallic material Cast iron and Non Metallic material Nylon. The pressure investigations carried out in the headstock region are dissected by limited component examination. Diagnostic bowing pressure is figured by two recipe Lewis equation and AGMA recipe. Explanatory outcomes are contrasted and the limited component strategy result for approval. Finishing up the examination, we watched that limited component strategy programming ANSYS have estimations of stress dispersion were in great concurrence with the hypothetical outcomes. Other than non-metallic material can be utilized rather than metallic material in light of the fact that non-metallic material gives additional advantages like as less cost, self-greasing up, low level clamor, least possible vibration and simple assembling.

R. Yakut^[5] the motivation behind the analysis is to evaluate the heap limit of PC/ABS plastic foot riggings and examination of apparatus harm. Assist in this examination convenience of PC/ABS, which is a kind of composite plastic material as footing gear was researched and was characterized that PC/ABS composite gears were tried by applying three distinctive stacking at two unique quantities of insurgencies on the FZG trials. The trial result condensed that the use of PC/ABS materials acquires favorable position numerous mechanical zone on the grounds that such materials are solid against fire, air, bright lights and holding lower moister than PA66 GFR 30 materials. Another aftereffect of this examination was that great working conditions are contained at low quantities of upset and the tooth loads. Encourage the reasonable ecological condition must be upsets and the tooth stack for gears. PC/ABS

composite apparatus ought to be favored at low tooth and undesirable high power transmission.

M. Patil^[6] The target of his publications is to think about the free vibration conduct of composites goad outfit utilizing limited component strategy which is otherwise called first request shear distortion plate hypothesis (FSDT). The limited component examination has been completed for composite apparatus as a 4 gestured and 8 gestured quadrilateral component with every hub has five level of flexibility. Limited component detailing of composite rigging is displayed and coded utilizing MATLAB. In light of the numerical examination which is done for of goad adapt the accompanying an imperative conclusion can be entitled. The created MATLAB code is approved with the accessible outcome and it can be inferred that the present FE software code result are in great concurrence with those that were referred. Principal frequencies acquired for composite goad outfit utilizing MATLAB are exhibited. It has also been discovered that normal recurrence increments with increment in fiber introduction.

Nitin Kapoor^[4] In his paper publication the parametric model of differential machinery setup is produced utilizing a few constrained parameters which includes number of teeth, Pressure edge, point of helix, tooth thickness & module) in CATIA-V5 version and weight examination of the same differential apparatus box for various material which is inclusive of Aluminum compound, combination steel, cast press, Glass filled Polyamide, under static stacking conditions utilizing the FEA software. The contextual investigation demonstrates that the composites can be utilized viably instead of metallic material in light of the fact that the heaviness of Glass embedded Polyamide composite material of differential system is decreased by 60% contrasting and the conventional materials (Aluminum compound, Alloy Steel, Casted press). Along these lines, we infer that Glass embedded Polyamide Composite material is chosen as one of the best material for differential apparatus unit.

A.D. Dighe^[7] in this examination the relative execution goad rigging of 30% Glass embedded PA66 and 30% Glass embedded PEEK was researched at various torque and speed. Wear trial of the goad equip sets and the examination goad outfit tooth were performed on a FZG testing machine. A weight by reduction is estimated by an amount of 0.0001g delicate measuring machine and the gear tooth temperature of apparatus is estimated by using an Impact infrared thermometer. Post the testing, the after effect of PA66 GF30 composite apparatuses and PEEK GF30 composite gears are at various torque values and speed values. The tooth temperature gradually increments with incremental torque and expanded temperature gradient which exhibited a warm softening of apparatus tooth which additionally builds particular wear rate.

Pradeep Kumar Singh^[8] in his paper utilizes ANSYS module related to workbench programming, twisting pressure, contact pressure and static load executed on the tooth of footing gear drive setup is evaluated. The Hertz



hypothesis and the Lewis equation likewise are utilized for hypothetical figuring of the contact pressure and twisting worry of goad outfit. We watched that Ideally comes about acquired by Le wis recipe and Hertz condition are practically identical with limited component investigation of goad outfit, remembering the correlation we can reason that the limited component expository outcome can be better as a critical thinking programming and utilized for other examining reason.

Mrs. C.M. Meenakshi (2012) [9] the target of paper is to contemplate the different pressure condition of footing gear. They figured the digressive and spiral powers which follows up on different point upon that premise we can break down by applying the powers. By utilizing Ansys programming twisting pressure and contact weight on the tooth of goad equip drive is discovered Gears are mechanical machinery components used as a transmit control device between turning shafts by methods for commitment of projection called teeth. Apparatuses are most normal methods for transmitting power in the wooden mechanical world. They change from a small size utilized as a part of watches to bigger riggings utilized as a part of huge speed reducers, connect lifting system and rail street turn table drive. The riggings are indispensable components of principle and helper instrument in numerous machines, for example, cars, tractors, metal cutting machine devices moving plants facilitating and transmitting and transporting apparatus, enormous motors and so forth.

Atul Kumar (2013) [10] Says that footing gears wear either because of rubbing activity that happens between the fit riggings or by undesirable components like unclean particles, metallic sections, and so forth which diminishes its productivity and administration life. It is dependably a testing assignment to decide the rest of the lifecycle of a segment or the quality of a segment once wear has happened on the tooth surface. This publication introduces a use of figuring out methodology for recreation of the goad outfit 3D CAD display utilizing examined information. An apparatus has been filtered utilizing PICZA 3D laser scanner (RolandLPX60).

M. Raja Roy (2014) [11] Made an endeavor to outline about the contact stresses created in a mating surface of the footing gear which has an involute teeth. A couple of footing gears were taken from a machinery setup and continued proceeding forward to figure contact weights on their teeth. The Contact disappointment in gears is presently anticipated by contrasting the ascertained Hertz contact worry with tentatively decided permissible qualities for the given material. The strategy for figuring gear contact worry by Hertz's condition initially inferred for contact between two chambers. Systematically these contact stresses are figured for various module, and these outcomes are contrasted and the outcomes got in demonstrating examination in ANSYS.

III. MODELING IN CATIA V5

Computer Aided Three-dimensional Interactive Application abbreviated as CATIA, is a multi-stage CAD/CAM/CAE business programming suite created by the popular French organization called Assault Systems. Written completely in the C++ programming dialect, CATIA is the

basic foundation of the Assault Systems lifecycle administrative programming suite.

CATIA also offers a solution for shape configurations, styling formats for the same, surfacing the work process and their representation to make, change, and approve complex innovative shapes from modern outline techniques to a Class-A surfacing with the so called ICEM surfacing innovations. CATIA bolsters numerous phases of modeling plan whether began without any preparation or from any 2D outlines. CATIA can read through and create a STEP design documents for figuring out and surface reuse properties.

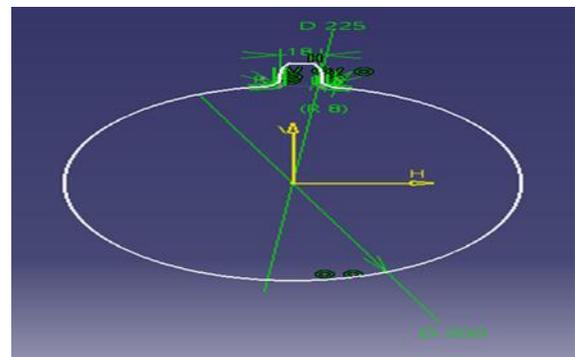


Figure.1. sketch model

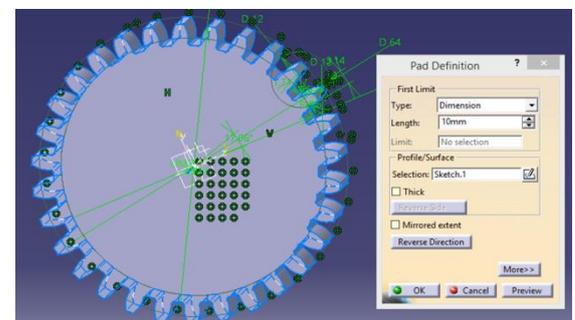


Figure.2. Portray drawing of model 3d display

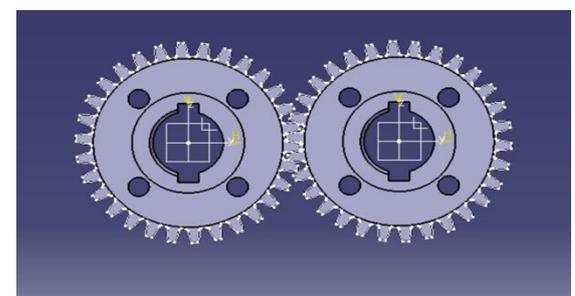


Figure.3. Assembly of Gears

IV. MATERIAL DATA

4.1. Gray Cast Iron

Young's Modulus	1.1e+005 MPa
Poisson's Ratio	0.28
Bulk Modulus	83333 MPa
Shear Modulus	42969 MPa

4.2. Aluminum Silicon Carbide

Young's Modulus	1.5e+005 MPa
Poisson's Ratio	0.3

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Bulk Modulus	$1.25e^{+005}$ MPa
Shear Modulus	57692 MPa
Density	$2.81e-006$ kg mm ⁻³

4.3. Carbon steel

Young's Modulus	$2.012e+011$
Poisson's Ratio	0.3
Bulk Modulus	$1.6767e+011$
Shear Modulus	$7.7385e+010$
Density	$7.8334e-006$ kg m ⁻³

V. ANALYSIS OF TRACTION GEAR USING ANSYS

ANSYS is one of the broadly used limited component analysis software design, which empowers the architects worldwide to perform astoundingly with the complementary accomplishments:

- Build a specific PC model or exchange CAD model of concrete structures, building items, construction segments or frameworks
- Apply working conditions like load, deviations with respect to the dimensions or other outline execution conditions.
- Study the physical reactions, for example, feelings of anxiety, stress level variations, temperatures dispersions or the effect of electromagnetic fields, weather waves.
- Upgrade an outline from the get-go in the improvement procedure to decrease generation costs.
- A run of the mill ANSYS investigation software has three unmistakable advancements.
- Pre Processor.

5.1 Ansys Results For Aluminum Silicon Carbide

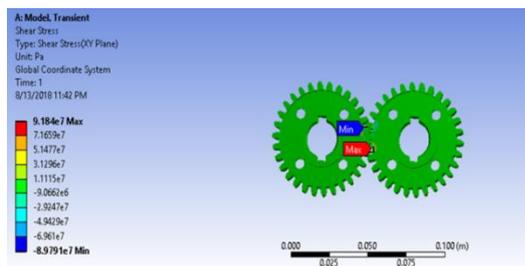


Figure.4. Total Deformation for AlSiC

The figure 4 shows the Total Deformation for Aluminum Silicon Carbide in traction gear with a maximum value of $7.1883e^{-005}$ MPa and minimum value of $2.0737e^{-005}$ MPa.

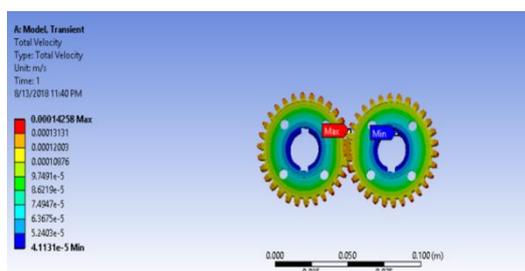


Figure.5. Total velocity for AlSiC

The figure 5 shows the Total velocity for AlSiC in traction gear with a maximum value of $4.1131e^{-005}$ m/s and minimum value of $1.4258e^{-004}$ m/s.

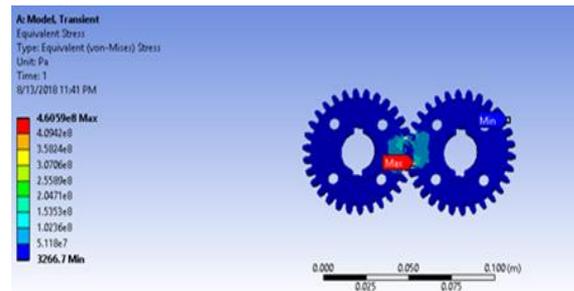


Figure.6. Equivalent Stress for AlSiC

The figure 6 shows the Equivalent Stress for AlSiC in traction gear with a maximum value of $4.6059e^{+008}$ MPa and minimum value of 3266.7 MPa.

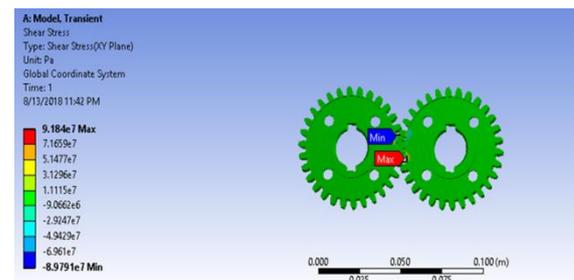


Figure.7. Shear Stress for AlSiC

The figure 7 shows the Shear Stress for AlSiC in traction gear with a maximum value of $9.184e^{+007}$ MPa and minimum value of $-8.9791e^{+007}$ MPa.

5.2. Comparing the Ansys Results

Table.1. Comparison of ansys results

Object name	Grey cast iron	Carbon steel	Alsic
Total deformation (mm)	$3.6832e^{-003}$	$1.2851e^{-004}$	$7.1883e^{-005}$
Total velocity (m/s)	$7.3055e^{-003}$	$7.3055e^{-003}$	$1.4258e^{-004}$
Equivalent stress (mpa)	$4.5452e^{+008}$	$4.6106e^{+008}$	$4.6059e^{+008}$
Shear stress (mpa)	$8.5543e^{+007}$	$9.3032e^{+007}$	$9.184e^{+007}$

- The total deformation of traction gear for AlSiC is very less ($7.1883e^{-005}$ mm) when compared to other materials.
- The Shear stress produced for AlSiC is of $9.184e^{+007}$ MPa which is much more than Grey Cast Iron but very slightly less than Carbon Steel.
- Total velocity produced by traction gear for AlSiC is more than Carbon Steel and Grey Cast Iron

- Also the Equivalent Stress produced by AlSiC material is more i.e., AlSiC has more stress bearing capacity than the carbon steel and the original material, Grey cast iron.

Therefore Aluminum Silicon Carbide is best material for this project work. A test piece of traction gear is manufactured and then experimental tests are conducted on the test piece to validate the Ansys results.

VI. EXPERIMENTAL RESULTS FOR AlSiC

6.1. Impact Test

Table.2. impact test results for AlSiC

Observed Values (joules)	Al-SiC
Impact 1	32
Impact 2	0
Impact 3	0
Average	32

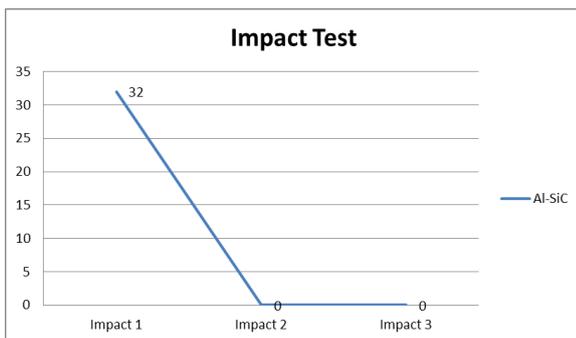


Figure.8. Impact Stress graph for AlSiC

6.2. Shear Test

Input data		
Material specification	Aluminium silicon carbide	
Specimen piece	Gears sample piece	
Output data		
Al-SiC	Applied force (KN)	Shear Stress (MPa)
	12	9.0135×10^4

VII. CONCLUSION

At the point when the mankind began utilizing wheels they found the prerequisite of a regular wheel which can diminish or increment the rotational speed so the rigging was created. The greater part of the power transmission hardware's comprise of apparatus gatherings; commonly outfits assume a critical part. In this examination, to comprehend the conduct of rigging materials as for stresses Finite Element Analyses were completed.

- Based on that review, the examination of aluminum silicon carbide, Carbide steel, cast press is dissected in the use of rigging confine which is utilized transmission framework.

- It was discovered that aluminum silicon carbide have great obstruction qualities when contrasted with different materials.
- So from these examination comes about, we presume that, the pressure incited, aluminum silicon carbide twisting of footing gear is less when contrasted with the other material rigging.
- In display examination aluminum silicon carbide material gave great withstanding values comparing with other materials so finally aluminum silicon carbide is better suitable materials for gears

FUTURE SCOPE

In the present undertaking, auxiliary and model investigation of footing gear is finished by various materials and carbon epoxy gave best outcomes. There is extent of utilizing other kind of composite materials other than said materials and better outcomes can be accomplished, can build the quality and thus increment the life of riggings and can be utilized as a part of different ventures for better outcomes.

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