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DESIGN AND STRESS ANALYSIS OF HELICAL GEAR USING FINITE ELEMENT ANALYSIS BY TRIPLE ANGLE LOAD APPLYING METHOD

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***Abstract** – The bend and surface stresses of gear tooth are major factor for failure of gear. Pitting is a surface fatigue failure due to repetition of high contact stresses. This paper investigates finite element model for monitoring the stresses induced of tooth flank, tooth fillet during meshing of gear. The involute profile of helical gear has been modelled and the simulation is carried out for the bending and contact stresses, and the same have been estimated. To estimate bending and contact stresses,3D models for different helical angle, face width are generated by modelling software and simulation is done by finite element software package. Analytical method of calculating gear bending stresses uses AGMA bending equation and for contact stress AGMA contact equation are used. It is important to develop appropriate models of contact element and to get equivalent result using Ansys and compare the result with standard AGMA stress.*

Key Words: MPCM, FEA, MMC, *AGMA, ANSYS WORKBENCH, SOLIDWORKS, VCR system, performance improvement.*

1. INTRODUCTION

. Gears are used for transmitting strength among the shafts. It is one of the best techniques for transmitting torque, power, angular velocity and movement. The helical tools is used to transmit motion and energy between parallel, non-parallel and intersecting shafts. In this thesis, we're going to be discussing helical gears and the forces which are transmitted thru them. A helical tools is just like a spur equipment however in helical equipment has a helix attitude to the vital axis of the shaft. The important axis (Z) is the axis that is going thru the hole in the center of the equipment and there may be some perspective with admire to that axis that is called the helix angle. So that helical gears are top notch because it has factor and line touch and it allows you to have for extra mild engagement. This observe investigates the most contact pressure, which improves the weight-sharing capacity of a helical gear set with localized bearing contact, by means of finite detail evaluation (FEA). In the equipment design, failure of the tools in a equipment set pressure and floor power are considered to be one of the essential reason and it will optimize for get maximum existence for tools enamel.

Gears are used for transmitting energy between the shafts. Gears are one of the maximum essential additives in mechanical strength transmission structures. Helical gear is used to transmit motion and energy between parallel, non-parallel and intersecting shafts.

The speedy development of industries along with shipbuilding, vehicles and plane require advanced software of gear technology. In this thesis we're going to be discussing helical gears and the forces that are transmitted via them so a helical tools is just like a spur tools besides that the enamel are at a helical perspective with appreciate to the principal axis of the shaft. The relevant axis (Z) is the axis that is going through the hole in the middle of the equipment and there may be a few perspective with admire to that axis that is called helix attitude

LITERATURE SURVEY

Linhong Xu et al., has performed paintings on "Stress Analysis and Optimization of Gear enamel .The operational performance of tools concerning smoothness, quietness, put on and existence span is essentially suffering from how tools and pinion enamel make contact enamel profile plays a very vital function in influencing contact situation at some point of equipment transmission. Analytic effects are offered to illustrate the better overall performance of equipment below heavy load in tools transmission and courting between drum formed size design and load.

B.Venkatesh, et al., stated that, the stresses generated and the deflections of the enamel were analyzed for different materials. The results acquired through theoretical evaluation and Finite Element Analysis are as compared to check the correctness. A end has been arrived on the cloth that is fine suitable for the marine engines based totally at the outcomes. Basically the assignment entails the "design, modeling and production of helical gears" in marine packages.

Arvind Yadav et al., has executed his paintings on "Different kinds Failure in gears". The objective of this paper is to present their recent improvement inside the subject of equipment failure analysis. By the help of this paper we are able to understand approximately one of a kind of failure detection and reading strategies which is used to reduce these screw ups from gears.

Pawan kumar et al., The paintings presented here is the study of thermal analysis of a three level helical gearbox. Firstly the layout of the gearbox is achieved through empirical formulation. The 2D drawing is then drafted to a 3-d model via three-D modeling software program. The thermal analysis is finished for the temperature generated on the tip of the mating gears.

Govind T Sarkar studied the bending and floor stresses of tools tooth are essential element for failure of gear. Stress Analysis of Helical Gear through Finite element Method This paper investigates finite element version for monitoring the stresses precipitated of enamel flank, tooth fillet during meshing of gears. The involute profile of helical tools has been modeled and the simulation is executed for the bending and contact stresses and the equal were anticipated. Analytical methods of calculating equipment bending stresses makes use of bending equation and for touch pressure contact equation are used.

A.Y Gidado et al., The two stresses outcomes within the failure of equipment tooth, root bending pressure results in fatigue fracture and contact stresses effects in pitting failure on the contact floor. To estimate the bending pressure, three dimensional stable models for special face width are generated by using Pro/Engineer that may be a powerful and modern stable modeling software program and the numerical solution is finished by using ANSYS, that is a finite element evaluation package deal.

MATERIAL PROPERTY TABLE:

3.1: Material Property

Elastic Modulus	210000	N/mm2
Poisson's Ratio	0.28	N/A
Shear Modulus	79000	N/mm2
Mass Density	7700	kg/m2
Tensile Strength	723.8256	N/mm2
Yield Strength	620.422	N/mm2
Thermal Expansion	1.3e-005	/K
Thermal Conductivity	50	W/(m·K)
Specific Heat	460	J/(kg·k)

Table no 3.1 Material property

3.2 PARAMETRIC MODELING OF HELICAL GEAR:

Parametric modeling lets the design engineer to permit the feature parameters of a product pressure the design of that product. During the gear layout, the primary parameters that might describe the designed tools along with module, strain angle, and root radius, and enamel thickness, range of tooth could be

Table 3.2: Dimensions of Helical Gear

S.No.	Data	Gear
1.	Power(KW)	$20x10^3$
2.	Speed(rpm)	1440
3.	Teeth	25
4.	Normalmodule(mm)	5.18
5.	Pressureangle	20
6.	Helixangle	15
7.	Transversemodule(mm)	5
8.	Pitchdia.(mm)	129.5
9.	Pitch (mm)	16.27
10.	Pa (mm)	60.72
11.	Facewidth(b) (mm)	72.86
12.	Velocitym/s	9.76
13.	db1 (mm)	121.7
14.	Addendum(mm)	5
15.	Dedendum(mm)	6.25
16.	Torque(Nm)	132.63

But, the parameters do no longer must be handiest geometric. They also can be key procedure records inclusive of case hardening specifications, Quality of grades, metallurgical homes or even load classifications for the gear being designed.CAD software programs permit for modeling and simulation of 3-d parametric modeling of helical equipment. It also an awesome interface with Finite Element software program. ProE has model the involute profile helical gear geometry perfectly. For helical equipment in ProE, relation and equation modeling is used.

Table 3.3: Design Parameter for Helical Gear

Variable Name	Value	Description
Z	25	No. of Teeth
D	129.5	Pitch Diameter (mm)
P	16.27	Diametrical Pitch (mm)

The above parameters determine the ultimate all parameters that define teeth profile. After the round disc is extruded having diameter equal to addendum diameter and thickness same to face width. Next step is to generate datum involute curve thru equation function. Then an involute curve utilized in a sketch to make an extruded cut via the equipment blank and enamel space is generated. After unmarried tooth area is generated it needs to be patterned along the centre axis of tools cleanly. The helical tools model created after patterning the tooth space as proven in Figure 1. The gear profile is reduce through extrude such that to get single enamel with gear blank as

3.3 HELICAL GEAR PARAMETERS:

A helical gear train with parallel axes may be very similar to a spur tools with the identical teeth profile and proportions.

Helix Angle :

The helix angle of helical gears β is commonly selected from the range 6,8,10,12,15,20 tiers. The large the angle the smoother the motion and the better speed feasible but the thrust loadings on the helping bearings also will increase. In case of a double or herringbone equipment β values 25,30,35,40 levels also can be used. These large angles may be used due to the fact the side thrusts on the 2 sets of enamel cancel each different allowing large angles with no penalty.

Pitch /module:

For helical gears the round pitch is measured in methods The traverse circular pitch (p) is the same as for spur gears and is measured alongside the pitch circle The normal circular pitch p n is measured ordinary to the helix of the gear.

1. The diametric pitch is the same as for spur gears ... $P = z_g / d_g = z_p / d_p$ .... D= pitch circle dia (inches).
2. The module is the same as for spur gears ... $M = d_g / z_g = d_p / z_p$..... D = pitch circle dia (mm).

3.4 HELICAL GEAR GEOMETRICAL PROPERTIONS:

- $\boxed{p = \text{Circular pitch} = d_g . \square / z_g = d_p . \square / z_p}$
- p_n = Normal circular pitch = P /Cosβ.
- P_n =Normal diametrical pitch = P /cosβ
- p_x = Axial pitch = p_c/tanβ α n = Normal strain angle = tan -1 (tanα.Cos β)
- β =Helix angle
- d_g = Pitch diameter tools = zg. M
- a =Center distance = $(z_p + z_g)* m_n /2 \cos \beta$
- a_a = Addendum = m
- a f =Dedendum = 1.25*m

3.5 CROSSED HELICAL GEARS

When two helical gears are used to transmit strength among non parallel, non intersecting shafts, they're normally known as crossed helical gears.

These are virtually regular helical gears with non-parallel shafts. They want no longer have the equal helix perspective and that they do no longer want to be opposite hand.

The contact isn't an amazing line contact as for parallel helical gears and is frequently little greater than a factor touch

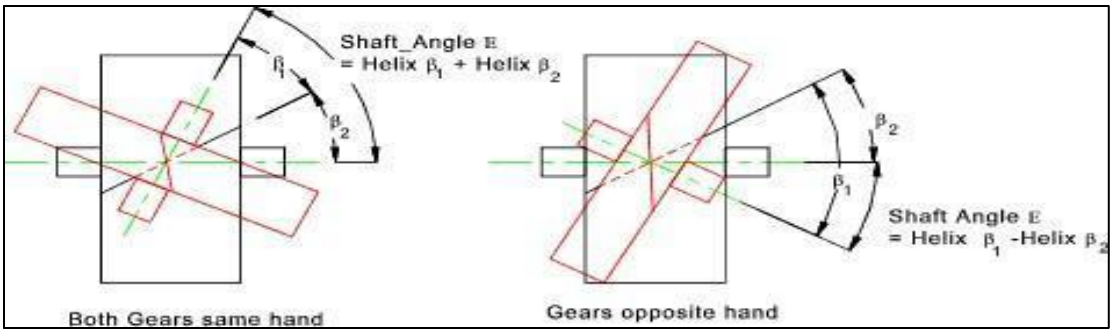


Figure 1. Four crossed helical gears

For gears with a 90o crossed axis it's far apparent that the gears must be the identical hand.

The centres distance (a) among crossed helical gears is calculated as follows

$a = m * [(z_1 / \cos \beta_1) + (z \cancel{1} / \cos \beta_1)] / 2$

The sliding velocity Vsof crossed helical gears is given by using

$$V_s = (V_1 / \cos \beta_1) = (V_2 / \cos \beta_2)$$

3.5.1 Strength and Durability calculations for Helical Gear Teeth

Designing helical gears is typically completed according with requirements the 2 most popular series are listed below requirements above: The notes underneath relate to approximate techniques for estimating equipment strengths.

A) Standards.

B) Books are to be had presenting the important guidance.

C) Software is likewise to be had making the system very easy. A very reasonably priced and easy to apply package deal is covered in the hyperlinks beneath. Bending**:** The Lewis components for spur gears can be carried out to helical gears with minor modifications to offer an initial conservative estimate of gear energy in bending.

$$\sigma = F_b / (b_a . m. Y)$$

- F_b = Normal force on enamel = Tangential Force Ft / cos β
- σ = Tooth Bending stress (MPa) b~~a~~ = Face width (mm)
- Y = Lewis Form Factor • m = Module (mm)

When a equipment wheel is rotating the tools tooth come into contact with a few degree of effect. To allow for this a speed thing is brought into the equation. This is given by way of the Barth equation for milled profile gears. $K_v = (6{,}1 + V) / 6{,}1$

V = the pitch line pace = PCD.W/2

The Lewis formula is therefore changed as follows

$\boldsymbol{\sigma = K_v . F^b / b_a . M. Y}$

The Lewis shape element Y need to be determined for the virtual number of enamel z' = z /cos3β The bending strain ensuing has to be much less than the allowable bending pressure Sb for the equipment material under attention.

Surface Strength:

The allowable equipment force from floor durability concerns is decided about using the easy equation as follows $\mathbf{Fw = K_v\, d_p\, b_a\, Q\, K / \cos^2\beta}$

$$K = \frac{S_e^2 \sin\alpha}{1.4}\left(\frac{1}{E_1}+\frac{1}{E_2}\right) \quad \mathbf{Q = 2.\, D_g /(\, d_p + d_p\,) = 2.Zg /(\, z_p + z_p\,)}$$

F_w = The allowable tools load. (MPa)

K = Gear Wear Load Factor (MPa) received by appearance up ref Gear Strength Values

4. SOLID MODELING OF GEAR PAIR:

In the primary level of version designing of our gear the use of the metric module machine although we should simply as without difficulty create a equipment using the diametral pitch in the ANSI device. The distance among centers the tools ratio or the variety of teeth or the diameter or pitch or the module. In our case and in this situation we need to create a one-millimeter module tools with 20 enamel. The global variables need to be encapsulated by prices. We're going to go into the module value 1 formerly mentioned it is one millimeter.

4.1 Variables for Solid Model

Name	Value/Equation	Evaluates
Global Variables		
"Module"	= 1mm & 1.25mm	1mm
"Number ofTeeth"	= 20	20
Equations		
"AddendumCircle"	(Number of teeth+2) × Module	22mm
"Pitch Circle"	Module × Number ofTeeth	20mm
"Whole Depth"	Module × IIF (Module = > 1, 2.25)	2.25mm
"Fillet"	Module × 0.3	0.3mm
"Circular pattern"	Number of teeth	20
"Angle of involute from center"	180/Number of teeth	9deg
"Helix Angle"	=12 deg	12deg

Table no.4.1: Variable for solid Model

The outside diameter, the bottom circle, the basis diameter and so on. The pitch diameter is one of the most crucial features of a tools. SolidWorks permits you to enter equations at the fly to solve for equation by way
of definitely urgent the equals key. Similarly, we create the stable model for module 1.25mm.

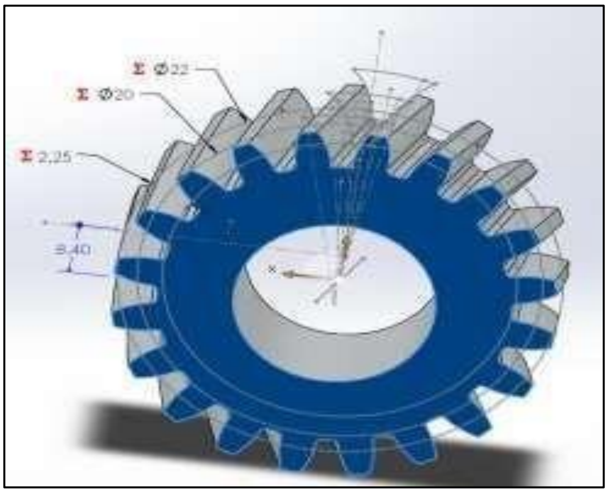


Figure -4.1: Solid Model with involute profile

Here Fig- suggests the configuration of gear pairs of helical gears. Suppose there are two gears established on shafts. One is the driving shaft and another is pushed. It’s rotating in the clockwise direction by way of energy.

4.2 PROPOSED WORK:

The essential goal of the undertaking is to design and evaluation a three-segment cyclical planetary helical tools reduction unit that's designed to meet the sixty four:1 discount ratio overall performance specifications. Our intention is to obtain a sixty four:1 reduction ratio for a cyclical 3-level planetary tools discount. The steps involved in Design and Analysis of Helical Gear are as follows

- Designing. •Modelling
- Analysis of Modelling of the Helical Gear the usage of ANSYS Software.

4.3 HELICAL GEAR MODEL SPECIFICATION:

Helical Gears are more precise examine to Spur Gear. The enamel 's main edges are not in keeping with the moving route, however at an attitude. This angling is a phase of the helix because the gear is curved. In Helix Angle, Angle between a tangent to the helix and the tools axis. Is zero inside the proscribing case of a Spur.

Helical Gear Geometric Proportion

P = Circular pitch = $d_g.P/z_g = d_p.P/z_p$ P_n = Normal round pitch = p.Cosβ

Pn = Normal diametrical pitch = P/cosβ Px = Axial pitch = computer /tanβ M_n = Normal module = m/cosβ

α_n = Normal stress attitude = tan-1 (tanα.Cos β) β = Helix perspective d_g = Pitch diameter gear = $z_g.M$ d_p =

Pitch diameter pinion = z_p.M a = Centre distance = $(z_p + z_g)* m_n /2\cos \beta$ a_a = Addendum = m a_f =Dedendum = 1.25*m

4. 4 DESIGN

Spur Gear are broadly used by experts because they're very easy to fabricate, if you need to transmit strength in between parallel shafts. In case of a few operations which includes Smoother Engagement, Noiselessness, Meshing of Teeth Helical Gears are preferred. When parallel Helical Mesh with every other, the subsequent condition should be happy.

Dept. Profile = 200 ; Helix Angle (β) = a hundred and seventy „ Max No:of teeth on pinion (Z_p) = 21; and Normal Module (M_n) = 5.Required to assemble the format[12]. **Table 4.2 Solid 3-d Module of Helical Gear**

Geometric Property	Gear	Pininon
No: of Teeth	51	19
Diameter of the Pitch Circle	261	105
Standard Design	6	6
Helix Angle	60^0	60^0
Width of the Phase	65mm	65mm
Angle of the Pressure	21	21
Diameter of addendum	271	114
Diameter of Dedendum	248	91

4.5 CALCULATION OF HELICAL GEAR STRENGTH:

To keep away from the failure and harm of the equipment at some stage in its lifestyles span a popular prerequisite are strictly maintained, a whole knowledge of person gear tooth required to calculate the weight carrying capacity. The maximum massive pressure we are taken into consideration for the duration of layout of gear are:

4.6 SOLID FRAME WORK MODELING OF HELICAL GEAR:

The undertaking engineer will use our shape to direct the creation of the issue in its characteristic parameters. The key parameters specifying the built gear may be used as criteria for determining the device throughout gear creation, as an example the modulus, the stress attitude and the wide variety of tooth.

4.6.1 ASSUMPTIONS:

1. The full strain is shipped in static nation on the tip of a unmarried tooth.
2. The minute Radial Component is utilized.
3. The load is shipped over the entire facial width evenly.
4. Powers are negligible no matter slipping friction.

5. The enamel fillet ache awareness is negligible.

The general bending pressure is calculated the usage of popular Lewis Bending Equation in keeping with AGMA Norms. The values that are obtained in the course of experiments are as follows

σ_b = Ft Kv Ko (zero.93Km) b m J Where,

- Face width (b) = 21mm • Load distribution component = 1.Three
- Geometry factor (J) = 0.593 Dynamic Factor (Kv) = 1.17
- Overload component (Ko) = 2.Zero

SL NO	RATING OF TORQUE	BENDING STRESS (σb)
1.	351	92
2.	401	405
3.	421	111

Table No.4.3 : Bending Stress for Different torque condition

5. METHODOLOGY:

- Design the helical gear. Material selection.
- Structure design. Import to ansys.
- Cad modelling. Export to iges format.
- The solid model. Select the analysis method.
- Put the input value of material.
- Solve the values by the way of analysis method.
- Take the result from result data sheet.

5.1 HELICAL GEAR ANALYSIS USING FEM (FEA)

Finite detail analysis is a computer-based totally computational device for the calculation inside the defined boundary country of structural energy and conduct. The arrangement of the FEM is defined as finite factors and joined of different sections, called the no definite element analysis is the numerical solution of the mechanical additives obtained with the aid of the decertification of the mechanical components into a restricted variety of constructing blocks (identified as elements).

The FEM studies is finished with the resource of an analytical technique ANSYS 14.0 for which we compare portions consisting of absolute deformation, relative of lost force, maximal shear anxiety, ordinary frequencies and mode types in real boundary conditions[6]. Numerical models in Creo three.0, which had been imported into ANSYS as IGES to be in addition evaluated, have been deliberate.

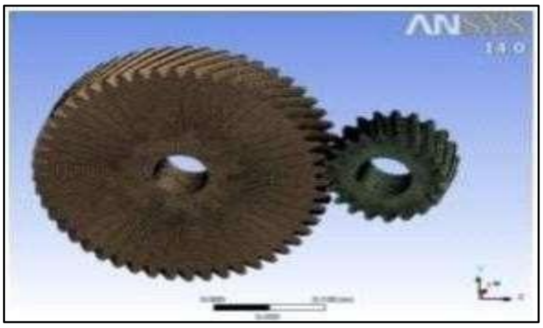


Fig No. 5.1: Gear Analysis Using FEM Technique electricity of fabric and properties

This task is designed to investigate, in comparison with well-known metal alloy tools assembly, the structural and vibrator houses of composite kind equipment for the heavy responsibility device. Substituting the composite fabric for the tools have gain of better precise power, less weight, better damping electricity, longer existence, lower essential pace and extra torque wearing capacity. At first, we expand wheel blanks. In the aircraft of the the front view we make sketches of an axial segment of the gear (Fig. 1, a) and the wheel (Fig. 1, d). We place an initial point on the rotation axis so that the plane of the right view could be a symmetry aircraft.

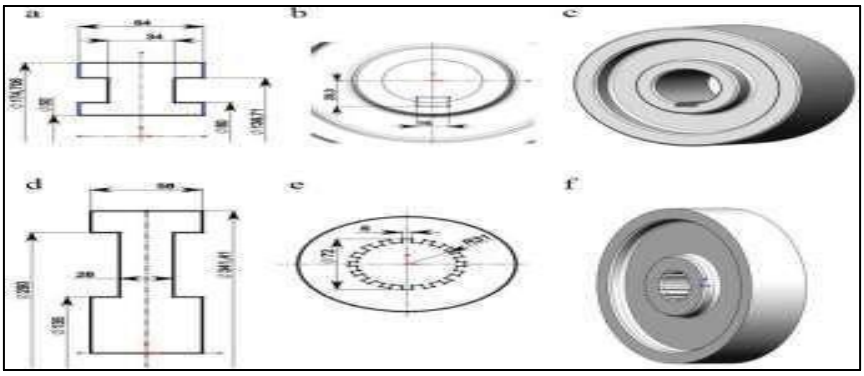


Fig. 5.2 Gear and wheel blanks: (a) caricature of tools phase; (b) caricature of key way; (c) tools clean; (d) sketch of wheel phase; (e) comic strip of splined bore; (f) wheel clean

5.2 CONSTRUCTION OF TOOTH RIMS OF A GEAR AND A WHEEL:

The everyday module m_n is standardized. Therefore, we make a contour of the helical gear tooth within the Plane which is perpendicular to the teeth curve. The production of the teeth rim we begin with a helix g, which specifies a direction of the enamel curve. We perform the subsequent movements so as a middle point of the helix may want to coincide with the pitch factor P (Fig. 2): by means of the commands. Helix and Spiral we set the parameters: height a hundred; regular pitch 2896,2225; clockwise; preliminary angle6,215°.

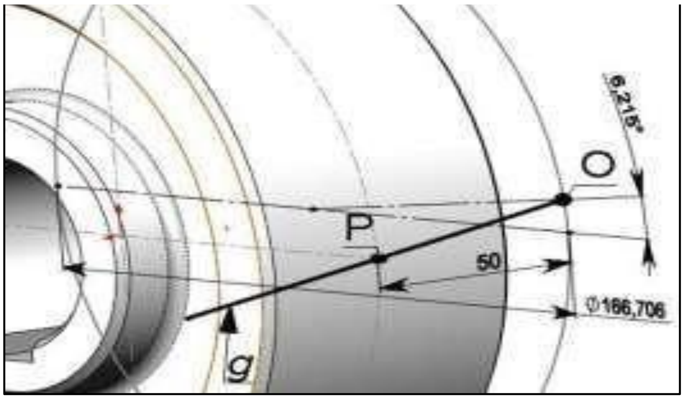


Fig. 5.3 Construction of a teeth curve

With the help of the acquired point we set a plane Ì perpendicular to the tooth curve (Fig. 3, a):

- Reference Geometry >Plane we specify conditions for the aircraft Ì: to undergo the point P and be perpendicular to the helix g.
- We trace a pitch circle of the equal wheel(dv1) in order that it touches the ellipse at the point P and its center Cv is at the minor axis of the ellipse.

5.3 ASSEMBLY OF THE HELICAL GEAR:

We open a brand new report 3-d association of parts and/or other assemblies. We spark off the command Layout on the panel Layout and make a format sketch (Fig. Five, a). We specify the pitch factor P inside the initial point and draw from it vertical segments, that are identical to the reference diameters of the equipment and the wheel.

Later on we perform the subsequent movements.

- Assembly>Insert Components inside the seemed window Property Manager we choose the tools file.
- For the regarded on the display tools version we specify mating: Concentric with the axis, Coincident of the lateral face of the rim with the quit point of the axis and we observe the equal operations to the wheel version. As a result, we've a 3D model of the helical equipment (Fig. Five, c). To take a look at the accuracy of the constructed version we conduct some of research.

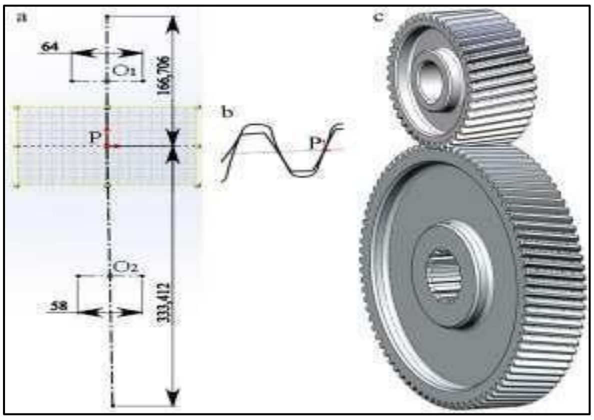


Fig. 5.4. Assembly of the helical-gear set: (a) format sketch;(b) mating of teeth within the pitch point; (c) 3-D version of the equipment

5.4 TESTING 3D MODEL OF THE HELICAL GEAR:

To look at the assembly accuracy we use the toolbar Evaluate, wherein we perform the subsequent commands: Selected Components, Clearance Verification.For modeling of "touch sample" dedication below load we turn the tools across the axis through zero,001°. The interference check shows bands along enamel face (Fig. 6, a).

The geometry of interlocking become tested in the gear plane phase, perpendicular to the axes and which goes via the pitch factor (Fig. 6, b). The strain perspective absolutely coincided with the calculated one Į$_t$ = arctg(tgĮ/cosǜ) = 20,3°.

In the everyday section deviation of length of the consistent chord and the tooth intensity from the calculated records didn't exceed ~five ʒm of the stress attitude – zero,033% (Fig. 7). The base tangent which characterizes distribution and a fee of clearance among enamel inside the gear has been calculated according to the following equation.

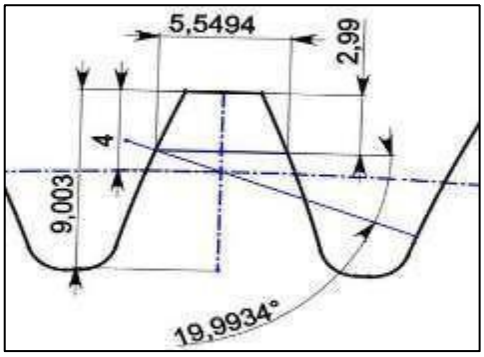


Fig.5.5 Parameters of the enamel contour within the ordinary segment

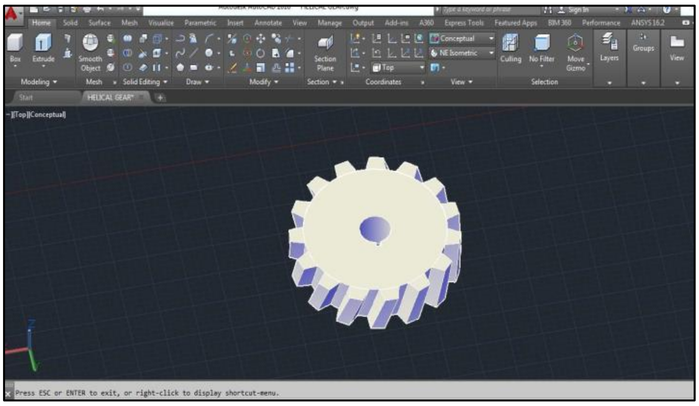
Inserting some of enamel of the tools and the wheel into the components, we get the subsequent calculated price of the bottom tangent period: W1 = fifty five,54030 for the tools; W2 = 116,9958 for the wheel. The deviation of average base tangent period Tvm(equipment –22,1ʒm; wheel –31,8ʒm) and the constant chord from the calculated values corresponds to mating H, E; tolerance h [6]. Thus, the studies on accuracy of the tools version show:

6. HELICAL GEAR ANALYSIS METHOD :(AGMA STANDARD)

American gear manufacturing association:

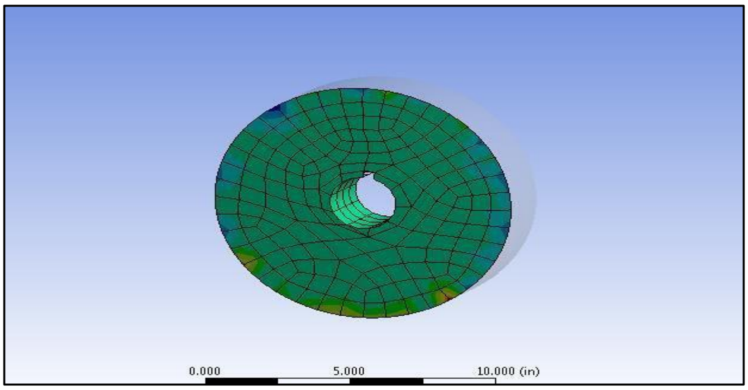
Gearbox element	Calculation type	AGMA	FEA
Gear teeth	pitting bending deflection	Yes Yes Limited	Yes Yes Yes
Shaft	stress deflection	Yes Yes	Yes Yes
Splines	stress deflection	Yes No	Yes Yes
Keys	stress deflection	Yes No	Yes Yes
Bolts	stress deflection	Yes No	Yes Yes
Housing	stress deflection	No No	Yes Yes
Assembly	stress deflection	No No	Yes Yes

CAD DESIGN:



CAD VERSION: AUTO CAD 2016

STRESS RESULT:

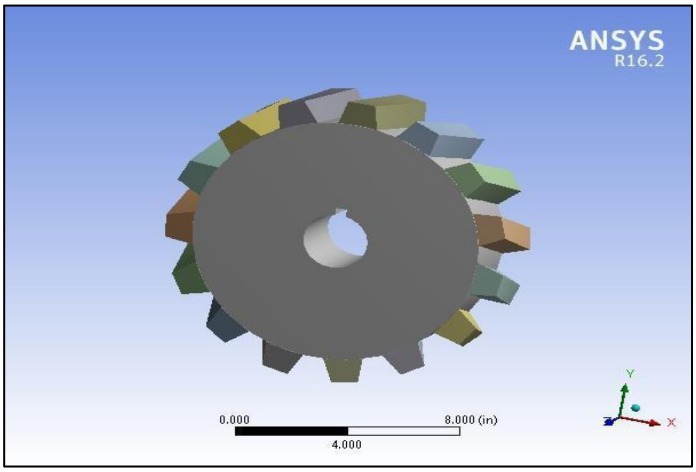


STATIC STRUCTURAL STRESS RESULT:

REPORT:

Project

First Saved	Friday, April 07, 2023
Last Saved	Friday, April 07, 2023
Product Version	16.2 Release
Save Project Before Solution	No
Save Project After Solution	No



Units

TABLE 1

Unit System	U.S. Customary (in, lbm, lbf, s, V, A) Degrees rad/s Fahrenheit
Angle	Degrees
Rotational Velocity	rad/s
Temperature	Fahrenheit

Model (B4) Geometric

TABLE 2 Model (B4) > Geometry

Object Name	*Geometry*
State	Fully Defined
Definition	
Source	D:\2022-2023\paavai ME project\HELICAL GEAR\HELICAL GEAR.igs NEW.igs
Type	Iges
Length Unit	Meters
Element Control	Program Controlled
Display Style	Body Color
Bounding Box	
Length X	13.023 in

Length Y	13.003 in
Length Z	2.8856 in
Properties	
Volume	300.28 in^3
Mass	85.158 lbm
Scale Factor Value	1.
Statistics	
Bodies	16
Active Bodies	16
Nodes	12960
Elements	2140
Mesh Metric	None
Basic Geometry Options	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	No
Parameters	Yes
Parameter Key	DS
Attributes	No
Named Selections	No
Material Properties	No
Advanced Geometry Options	
Use Associativity	Yes
Coordinate Systems	No
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	No
Compare Parts On Update	No
Attach File Via Temp File	Yes
Temporary Directory	C:\Users\Lenovo\AppData\Local\Temp
Analysis Type	3-D
Mixed Import Resolution	None
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

TABLE 3 Model (B4) > Coordinate Systems > Coordinate System

Object Name	*Global Coordinate System*
State	Fully Defined
Definition	
Type	Cartesian
Coordinate System ID	0.
Origin	
Origin X	0. in
Origin Y	0. in
Origin Z	0. in
Directional Vectors	
X Axis Data	[1. 0. 0.]
Y Axis Data	[0. 1. 0.]
Z Axis Data	[0. 0. 1.]

Connections

Nodes	619
Elements	96
Mesh Metric	None

TABLE 4 Model (B4) > Connections

Object Name	*Connections*
State	Fully Defined
Auto Detection	
Generate Automatic Connection On Refresh	Yes
Transparency	
Enabled	Yes

TABLE 5 Model (B4) > Connections > Contacts

Object Name	*Contacts*
State	Fully Defined
Definition	
Connection Type	Contact
Scope	
Scoping Method	Geometry Selection
Geometry	All Bodies
Auto Detection	
Tolerance Type	Slider
Tolerance Slider	0.
Tolerance Value	4.657e-002 in
Use Range	No
Face/Face	Yes
Face/Edge	No
Edge/Edge	No
Priority	Include All
Group By	Bodies
Search Across	Bodies
Statistics	

TABLE 6 Model (B4) >Analysis

Object Name	*Static Structural (B5)*
State	Solved
Definition	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
Options	
Environment Temperature	71.6 °F
Generate Input Only	No

TABLE 7 Model (B4) > Static Structural (B5) > Analysis Settings

Object Name	*Analysis Settings*
State	Fully Defined
Step Controls	
Number Of Steps	1.
Current Step Number	1.
Step End Time	1. s
Auto Time Stepping	Program Controlled
Solver Controls	
Solver Type	Program Controlled
Weak Springs	Program Controlled
Solver Pivot Checking	Program Controlled
Large Deflection	Off
Inertia Relief	Off

TABLE 8 Model (B4) > Static Structural (B5) > Solution

Object Name	*Solution (B6)*
State	Solved
Adaptive Mesh Refinement	
Max Refinement Loops	1.
Refinement Depth	2.
Information	
Status	Done
Post Processing	
Calculate Beam Section Results	No

TABLE 9 Model (B4) > Static Structural (B5) > Solution (B6) > Shear Stress

Time [s]	Minimum [psi]	Maximum [psi]
1.	-1.9048	3.1627

TABLE 10 Model (B4) > Static Structural (B5) > Solution (B6) > Shear Stress 2

Time [s]	Minimum [psi]	Maximum [psi]
1.	-36.222	36.771

CONCLUSION

Tooth layout conventionally based totally on bending principle. In the case of helical the character of touch between the mating teeth needs some research in contact stress. The AGMA has furnished the empirical relation for bending as well touch pressure. The Lewis principle and the hertzian approach additionally provide the relation of bending . The paintings performed commonly targeted on validation of the AGMA and Lewis and Hertzian ideas using FE approach. The mesh size and form of factors were selected after necessary considerations. Models are made for helix angle, face width. Each of the geometry was transformed for FE version and analyzed and the result obtained in analysis had been compared with AGMA std.

The face width and helix perspective are an essential geometrical parameters at some point of the design of gear. As it's miles anticipated, on this work the most bending strain decreases with increasing face width and it'll be better on gear of decrease face width with better helix perspective. As a end result, based in this locating if the cloth electricity price is criterion then a tools with any favoured helix attitude with distinctly larger face width is desired.

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