

Performance Analysis of Helical Gear

S. Nakkeeran

Abstract--- Helical gears are widely used in industry where the power transmission is required at heavy loads with smoother and noiseless operation. Helical gear are generally used to transmit power or torque for transmission at very high speed when compared to other kind of gear transmissions this application are explain the design the helical gear with defined specification. It's have an involving modern design, specific character, specific materials, with consideration of analysis of force, and its mechanical properties. In this project we design the helical by using solid works 2016 premium and perform the analysis by using solid works simulation by using different materials and different loads applied on it.

Keywords--- Helical Gear, Works Simulation, Performance Analysis.

I. INTRODUCTION TO GEAR

A equipment or cogwheel is a rotating device element having reduce enamel, or cogs, which mesh with some other toothed part to transmit torque, in most instances with enamel on the one gear being of same form, and regularly also with that form on the alternative tools.[1] two or more gears running in a sequence (train) are referred to as a tools teach or, in lots of instances, a transmission; such gear arrangements can produce a mechanical benefit through a tools ratio and accordingly may be taken into consideration a simple device. geared gadgets can trade the velocity, torque, and course of a strength supply. the maximum common state of affairs is for a tools to mesh with some other equipment; but, a equipment also can mesh with a non-rotating toothed part, known as a rack, thereby generating translation in place of rotation The gears in a transmission are analogous to the wheels in a crossed belt pulley device. a bonus of gears is that the teeth of a gear prevent slippage.

II. LITERATURE REVIEW

Nitin Kapoor, Virender Upneja, Ram Bhool and Puneet Katyal [1]. The main objective of this paper is to developed parametric model of differential Gearbox by using CATIA-V5 under various design stages. It is observed that Glass filled polyamide composite material is selected as best material for differential gearbox and is found to suitable for

different revolutions (2500 rpm, 5000 rpm and 7500 rpm) under static loading conditions. Comparisons of

III. INTERNATIONAL JOURNAL

IJPRES various stress and strain results using ANSYS-12 with Glass filled polyamide composite and metallic materials (Aluminum alloy, Alloy Steel and Cast Iron) are also being performed and found to be lower for composite material.

S. Nakkeeran, Assistant Professor, Department of Mechanical Engineering, BIST, BIHER, Bharath Institute of Higher Education & Research, Selaiyur, Chennai. E-mail: nakkeeran.mech@bharathuniv.ac.in

Introduction to Helical Gear

Helical gears are used for parallel shaft drives. They have enamel inclined to the axis as proven in fig. 1.nine. For this reason for the identical width, their teeth are longer than spur gears and have better load sporting capacity. Their touch ratio is higher than spur gears and that they operate smoother and quieter than spur gears. Their precision rating is ideal. They're recommended for extremely high speeds and masses. Hence, these gears discover extensive packages in car gearboxes as illustrated in fig. Their performance is barely decrease than spur gears. the helix perspective additionally introduces axial thrust on the shaft.

Helix Angle

In mechanical engineering, a helix angle is the angle between any helix and an axial line on its right, circular cylinder or cone. Common applications are screws, helical gears, and worm gears. The helix angle references the axis of the cylinder, distinguishing it from the lead angle, which references a line perpendicular to the axis. Clearly, the helix angle is the geometric supplement of the lead perspective. the helix attitude is measured in levels.

Concept: In terms specific to screws, the helix angle can be located via unraveling the helix from the screw, representing the phase as a right triangle, and calculating the perspective this is fashioned. note that while the terminology directly refers to screws, those ideas are analogous to maximum mechanical programs of the helix attitude The helix angle can be expressed as: Where l is lead of the screw or gear r_{ms} mean radius of the screw thread Or gear IJPRES.

Helical Gear Characteristics

- Helix angle 7 to 23 degrees
- More power More power.
- Larger speeds More smooth and quiet operation.
- Used in automobiles.
- Helix angle must be the same for both the mating.
- Produces axial thrust which is a disadvantage

Helical Gears Geometry and Nomenclature

The helix angle ψ , is always measured on the cylindrical pitch surface. ψ value is not standardized. It ranges between 150 and 450. Commonly used values are 15, 23, 30 or 45deg. Lower values give less end thrust. Higher values result in smoother operation and more end thrust. Above 45degrees is not recommended. Portion of a helical rack. The circular pitch (p) and pressure angle (α) are measured in the plane of rotation, as in spur gears. These quantities in normal plane are denoted by suffix n (p_n , α_n) as shown in Fig.

$$p_n = p \cos \psi$$

Normal module m_n is

$$m_n = m \cos \psi$$

m_n is used for hob selection.

The pitch diameter (d) of the helical gear is: $d = Z m$

$$= Z m_n / \cos \psi.$$

The axial pitch (p_a) is: $p_a = p / \tan \psi$

For axial overlap of adjacent teeth, $b \geq p_a$ (3.5) In practice $b = (1.15 \sim 2) p_a$ is used. In the case of a helical gear, the resultant load between mating teeth is always perpendicular to the tooth surface. Hence bending stresses are computed in the normal plane, and the strength of the tooth as a cantilever beam depends on its profile in the normal plane. Fig shows the view of helical gear in normal and transverse plane. Fig. shows the pitch cylinder and one tooth of a helical gear. The normal plane intersects the pitch cylinder in an ellipse. If d is the pitch diameter of the helical gear, the major and minor axes of the ellipse will be $d/\cos \psi$ and d . The radius of curvature R_e at the extremes of minor axis from coordinate geometry is found to be $d/(2 \cos^2 \psi)$.

IJPRES View of helical gear in normal and transverse sections The shape of the tooth in the normal plane is nearly the same as the shape of a spur gear tooth having a pitch radius equal to radius R_e of the ellipse. $R_e = d/(2 \cos^2 \psi)$

The equivalent number of teeth (also called virtual number of teeth), Z_v , is defined as the number of teeth in a gear of radius R_e :

Substituting $m_n = m \cos \psi$, and $d = Z m$

When we compute the bending strength of helical teeth, values of the Lewis form factor Y are the same as for spur gears having the same number of teeth as the virtual number of teeth in the Helical gear and a pressure angle equal to α_n . Determination of geometry factor J is also based on the virtual number of teeth.

Helical Gears - Force Analysis

$$F_r = F_n \sin \alpha_n$$

$$F_t = F_n \cos \alpha_n \cos \psi$$

$$F_a = F_n \cos \alpha_n \sin \psi$$

$$F_r = F_t \tan \alpha$$

$$F_a = F_t \tan \psi$$

$$\tan \alpha_n = \tan \alpha \cdot \cos \psi$$

Tooth force and its components acting on a right hand helical gear.

Helical Gears- Tooth Proportions

In helical gears, the normal module m_n should be selected from standard values, the first preference values are m_n (in mm) = 1, 1.25, 1.5, 2, 2.5, 3, 4, 5, 6, 8 and 10 The standard proportions of addendum and dedendum are $h_a = m_n$, $h_f = 1.25 m_n$, $c = 0.25 m_n$ The addendum and dedendum circle diameters are given by, respectively.

Helical Gears- Bending Strength

Beam Strength of a helical gear normal plane is considered equivalent to that of a spur gear in **IJPRES** tangential plane. Spur gear: beam strength, $S_b = m b \sigma_b Y$

Helical gear: beam strength, $(S_b)_n = m_n b_n \sigma_b Y_n$

Or

$$(S_b)_n = mn$$

But S_b is the component of $(S_b)_n$ in the plane of rotation, i.e.,

$$S_b = (S_b)_n \cos \psi$$

$$S_b = mn b \sigma_b Y_n$$

where Y_n will be calculated for $Z/\cos^3 \psi$ number of teeth.

Beam strength S_b indicates the maximum value of tangential force that the tooth can transmit without bending failure.

Selection of composite material

Based on the advantages discussed above, the high strength and high modulus aluminum silicon carbide materials are selected for composite helical gear. The properties of the aluminum silicon carbide material used for composite drive shaft. Aluminium alloy materials or simply composites are combinations of materials. They are made up of combining two or more materials in such a way that the resulting materials have certain design properties or improved properties. Aluminium Silicon carbide alloy composite materials are widely used for a many number of applications like engineering structures, industry and electronic applications, sporting goods and so on. The properties of aluminium metal matrix composite mostly depend on the processing method which is capable of producing good properties to comply the industry need. Al-SiC composites can be more easily produced by the stir casting technique due to its good cast ability and relatively inexpensive.

Preparation of aluminum silicon carbide

Preparation of aluminium-silicon carbide composite casting might be one of the maximum historical methods of producing metallic components. The metal matrix composite used within the gift paintings is prepared by the stir casting technique. For the coating of the aluminium silicon carbide composite through the use of stir casting mass foundation ratio of one hundred:2.5, a hundred: five, a hundred:7.5, and 100:10 are taken. Fig. 1 illustrates the raw materials and samples of aluminium silicon carbide cloth. Aluminium alloy within the form of ingots is used. The steel ingots are wiped clean and melted to the favored exquisite heating temperature of 750°C in graphite crucibles. Suggests schematic installation for stir casting method. A three-segment electrical resistance furnace with temperature controlling device is used for melting. For each melting three hundred - four hundred g of alloy is used. The fantastic heated molten steel is degassed at a temperature of 780°C. SiC particulates, preheated to round 500°C, are then introduced to the molten steel and stirred constantly by means of a mechanical stirrer at 720°C. The stirring time is between five and 8 mins. All through stirring, borax powder turned into introduced in small portions to growth the wettability of SiC debris.

Designing of helical Gear

Introduction To Solid Works

Solid works mechanical design automation software is a feature-based, parametric solid modeling design tool

which advantage of the easy to learn windows TM graphical user interface. We can create fully associate 3-D solid models with or without while utilizing automatic or user defined relations to capture design intent.

Modeling of helical gear is started with drawing the reference sketch for the gear radius and tooth profile. After generating the sketches go through the sweep feature Helical gear design is completed in solid works

IV. CONCLUSION

- Modeling and analysis of helical gear is done in solid works
 - Helical gear is designed by using various commands in solid works
 - Static analysis is done on helical gear in solid works simulation tool
 - Different materials at different loads are applied and stress, strain and displacement values are analyzed
 - The stress, strain and displacement values for different materials at different loads are noted and tabulated
- From the results aluminum silicon carbide and grey cast iron are more preferable when compared to chrome stainless steel because at a given load it is showing breakage

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