Advanced Design of gear Tooth Form and Their Analysis

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Abstract

Gear is a mostly used mechanical component whose generally use is to transmit power from one shaft to other shaft. There are Different types of gears namely spur gear, helical gears, worm gears etc. Gear drives are used to various kinds of application like automobiles, metal cutting tools, material handling equipments, rolling mills, marine power plants etc. The friction and other mechanical losses in this type of power transmission system is comparatively very low in practical applications. Therefore we introduce new type of Gear tooth form. We use software called "SOLID EDGE" to design gear, and namely "ANSYS" to Analysis the gears. ANSYS is extensively used for scientific & research purposes. It is accurate & also has a number of built in functions which makes it versatile. In this project new type of gear tooth form are designed. The program is a user friendly one & when executed it ask the inputs and performs the necessary design calculations and gives necessary output values. It also gives the involute gear tooth profile with accurate safe dimensions. As computers are used to perform the task of gear design becomes simple, friendly & error free. Then we compare it with some gears such as spur gear, helical gears and herringbone gears i.e. parallel axis gears. Then we found that new type of gear tooth form is stronger and efficient than other gear tooth form. Then we design various angled gear tooth form and find out optimum gear tooth form angle.

Index Terms: -*involute gear tooth form, load carrying capacity, law of gearing, gear terminology*.

I. INTRODUCTION

Gears are wheel-like machine component that have teeth same distance spaced around the outer surface. Gears can be produced from fraction of an inch in to a 100 feet in diameter. Gears are always used in pairs and are a very valuable design tool in automobile as well as industrial application. They are used in everything from cycle to jet engine and have been around for 2000 years.

Gears are mounted on rotatable shafts and the teeth are made to engage with a gear on another shaft. Gears deliver force (torque) and motion (rpm) from one part of a machine to another. Two gears with the driven gear having twice the number of teeth of the driving gear will rotate at one-half the speed of the driving gear and deliver twice the torque. Being able to control speed and torque by varying the number of teeth in one gear with respect to another makes gears a valuable design tool. An automobile transmission is an excellent example of how this principle is put to use to control vehicle motion.Element used for transmitting power and rotary motion from one shaft to another by means of progressive engagement of projections called teeth. Spur Gears use no intermediate link or connector and transmit the motion by direct contact. The two bodies have either a rolling or a sliding motion along the tangent at the point of contact. No motion is possible along the common normal as that will either break the contact or one body will tend to penetrate into the other. Thus, the load application is gradual which results in low impact stresses and reduction in noise. Therefore, the spur gears are used in transmitting power with very less friction losses.

II. LITERATURE REVIEW

Since many years we are using different types of gears. Let us discuss about them.

It imagines two disks are placed side by side, tangent to each other (both touching), if one disk was rotated, due to friction (caused by surface roughness) the other disk would also rotate (in the opposite direction) however; slippage would be introduced due to variation in the surface roughness. Now if we were to increase that surface roughness by cutting the disks and forming teeth on the circumference (circular outer part) then slippage would be eliminated. As a result, we

would have one of the most important fundamental mechanical devices, which can manipulate speed, torque and rotational axis. Almost all machines that involve rotation have gears. Gears are found in everything from cars to clocks.

III. OBJECTIVE

Objectives of this project is as follows:

1. The objective of the proposed project is to design and experiment the Gear which increases the load caring capacity in parallel shaft system.
2. Also to increase profit and efficiency by reducing required material far gear.
3. We need to introduce the new type of gear or change the gear tooth form which reduces the required material, maintenance. And increase the load carrying capacity, efficiency.

IV. METHODOLOGY

The principle of the project is simply defined with the help of following figures. As we see in the figure 1. The column loaded by some force. If there will be a chance to collapse of this column on the basis of the strength of the column material. If we support that by any support then there will be no chance to collapse of the column. This principle is used to design new type of gear tooth form.

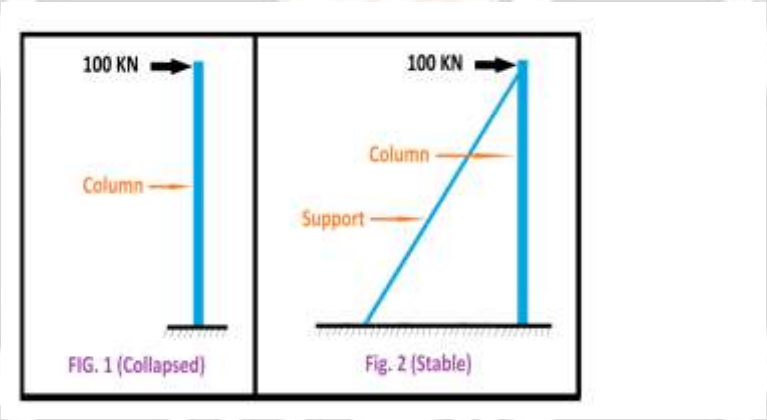

Fig. 1. Concept diagram.

We only change the form of the gear tooth. Other parameters of the gears such as profile of the gear tooth remain unchanged. Therefore the all parameters or design of all that parameters are belongs to literature survey of the spur gear.

This is comparative study based design project. With further study we analyze various gear tooth form at various angle of tangent of the curve of gear tooth. Also analyze the spur gear tooth with the help of ANSYS and compare those results with new type of gear tooth form.

A. Concept diagram

Fig. 2. Single gear

Fig. 3. Two gears with meshing.

V. RESULT

A. ANALISIS OF GEARS

With the help ANSYS software we analysis all type of gear tooth form at various angles. Example of the analysis is as follows. Following table shows various results of analysis. In this results load carrying capacity is based on yield strength of the material i.e. 250 N/mm2

TABLE I. GEAR TESTING RESULT

Angle of tangent of curve (Degree)	Stress (N/mm2) Load (N)			Load carrying capacity (N)
	20000	30000	40000	
10	176.64	264.95	352.99	28307.2
11	176.03	264.04	351.53	28411.73
12	175.43	263.13	350.67	28516.24
13	174.82	262.22	349.52	28620.75
14	174.21	261.31	348.36	28725.26
15	**173.6**	**260.4**	**347.21**	**28829.8**
16	**172.99**	**259.48**	**346.05**	**28934.3**
17	**172.38**	**258.57**	**344.89**	**29038.8**
18	**171.77**	**257.66**	**343.74**	**29143.3**
19	**171.17**	**256.75**	**342.58**	**29247.8**
20	**170.56**	**255.84**	**341.43**	**29352.3**
21	**169.95**	**254.93**	**340.27**	**29456.8**
22	**169.34**	**254.02**	**339.11**	**29561.3**
23	**168.73**	**253.11**	**337.96**	**29665.9**
24	**168.12**	**252.2**	**336.8**	**29770.4**
25	**167.52**	**251.29**	**335.65**	**29874.9**
26	166.91	250.37	334.49	29979.38
27	166.3	249.46	333.33	30083.89
28	165.69	248.53	332.18	30188.4
29	165.08	247.64	331.02	30292.91
30	164.47	246.73	329.82	30397.42

B. Spur Gear analysis Results:

TABLE II. SPUR GEAR TESTING RESULT

Angle of tangent of curve (Degree)	Stress (N/mm2) Load (N)			Load carrying capacity (N)
	20000	30000	40000	
Spur Gear	**189.21**	**251.29**	**335.05**	**26427.1**

C. Advantages

- At the same load caring capacity, this type of gear tooth form required less material compared to spur gear.
- Because of more contact ratio produced noise is low.
- No formation of axial thrust.
- High load caring capacity.
- Gear teeth experienced low stress.

VI. CONCLUSION.

- From all the analysis results we conclude that spur gear is weaker than the ADVANCED GEAR TOOTH FORM.
- As seen from the result table and graphs of the analysis, angle of advanced gear tooth form is directly proportional to load carrying capacity of gear.
- Optimum angle of advanced gear is in between 15-25 degree.
- As we see in result table if angle of the gear tooth form increases load carrying capacity of the gear will increases. But above the 25-degree angle gear teeth experience meshing problem.
- And below the 15 degrees angle no large change produced in load carrying capacity. Therefore, the optimum angle of the gear tooth form is 15-25 degree.

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