A REVIEW PAPER ON EPICYCLIC GEAR SYSTEM

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Abstract: Planetary gears are widely used in many industries. Since the gear of the planetary gear mechanism is one of the most important components, and one of the gears will affect the entire transmission system, it is necessary to find the cause of reducing the gear failure. epicycle gear have many advantages, such as increased torque, reduced comparative size, reduced weight, improved efficiency, and very compact packaging, so they have been widely used in industry, but there is no typical research on synthesis with respect to different parameters such as module, material, and power of the epicyclic gear trains. In planetary gear trains there is relative movement between the axes, which helps to transfer very high speed ratios in small dimensions into a small space. In this review paper we basically discuss the systematic method for the power-flow and static-force analysis of spur-gear drives is presented, also Loss of life, Damage of goods or property, loss of Production time due to down time of hoist. Better analytical modeling is needed to get more accurate analytical results. Therefore, the analysis models of strength and durability are focused on gear parts. This paper describes the most common planetary gear planes implemented in many automatic transmission systems.

Keyword: - Planetary gears, gear mechanism, power-flow, static-force, spur-gear, strength, transmission systems.

I. INTRODUCTION

The epicyclic gear contains many gears or gears, whose center is approximately one point. This is a gear train with fixed loop gear and three planetary gears on a rotating conveyor. The entrance is in the sun, and the exit is on board the trip of the planet. The movement is continuous because the planetary gear centers revolve around the sun, while the planetary gears rotate. Finding the transmission ratio is a bit difficult because the planetary gears rotate during rotation. Planetary gearboxes are widely used to effectively transmit the energy of electric vehicles. These types of gearboxes are compact and have a higher relationship with the weight of wild boar than with composite gear trains. As they are more efficient than common communal gears, they are increasingly used in the automotive sector, particularly in Formula Student electric vehicles. Particularly in comparison with the reduced single-step gearboxes of a single stage, these gearboxes are characterized by low space requirements and a high power / weight ratio [1]. The planetary gear makes the motor concentric with the drive shaft and provides more efficient parts packaging [1]. Instead of using a composite gears, the planetary gearbox can be used to obtain a high transmission ratio from a relatively compact gear arrangement.

The main goal of this system is to compensate for speed and torque to provide the power needed to accelerate the vehicle. Fig 1 reference taken from (**Timir Patel el al)**

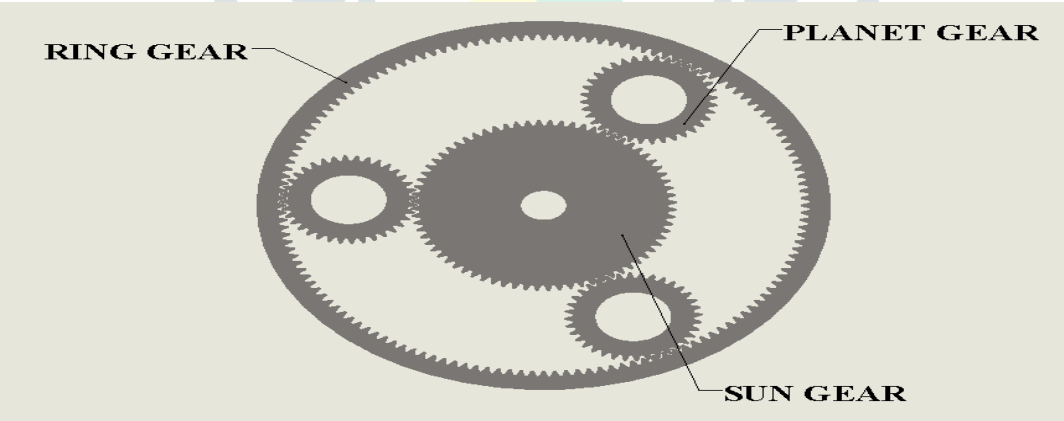

Fig. 1. Planetary Gear Arrangement

II. RESEARCH REVIEW

Timir Patel el Al [1] We can imply that an epicyclic gearbox can be used as an ideal solution to transmit energy to the differential for an electric car of formula. The change can transmit effectively
power and provide enough reduction to meet the static and dynamic requirements of the car in a compact design.

The finite element analysis performed in the gear geometry implied that the gears were safe and that the maximum equivalent stress on the gear tooth did not exceed the values allowed under the maximum load conditions. The maximum stress observed was approximately 48,695 MPa, as shown in Figure 3 reference taken from (**Timir Patel el al)**, which is well below the allowed limit. The maximum equivalent deformation has reached a maximum value of 0.0002366 shown in Figure 2 reference taken from (**Timir Patel el al)**.

The material used is resistant and can work against the wear load and the compression load on the gear teeth. The shaft material used is also suitable for the applied load and the axles are designed taking into account the operating conditions. The bearings used are selected on the basis of their dynamic load capacity and are designed to manage a sufficient number of cycles according to the operation. The housing is

made of 6061 aluminum alloy to reduce the total weight of the gearbox. The support is designed taking into account workability and low weight.

The gears are designed according to the Lewis equation and are verified from the dynamic point of view and from the point of view of the wear load. The modulus is maintained at an optimal value and the number of teeth in the gears is increased to accommodate the bearing in the planetary gear. This is done to satisfy the condition that the diameter of the hole must be between 60 and 70% of the diameter of the root of the gear.

ISO 68 SAE20W lubricating oil selected for our gearbox and the cup lubrication mechanism is selected for the gearbox based on the reduction ratio, operating temperature and RPM of the conveyor.

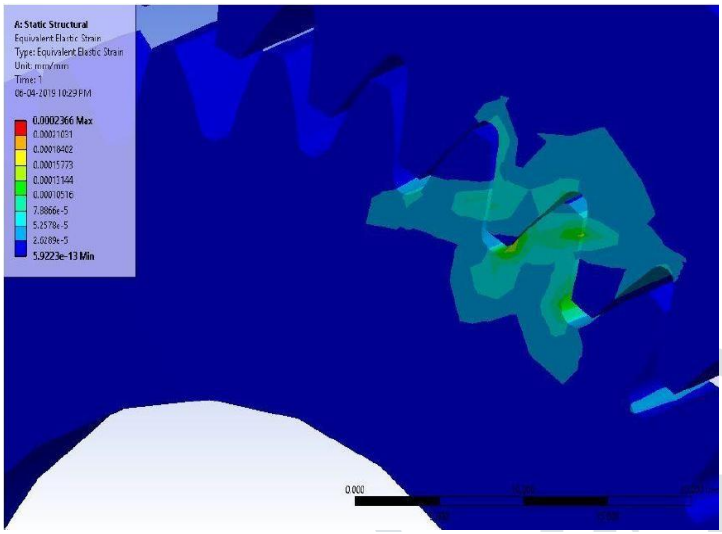

Fig. 2. Deformation in Planet and Ring Mesh

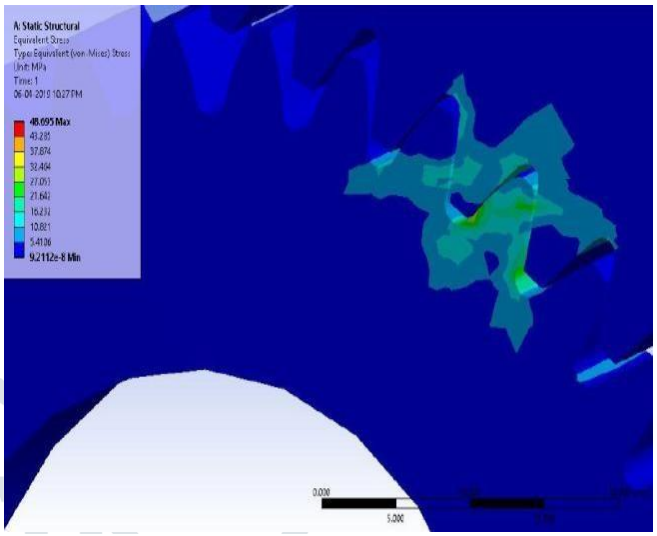

Fig. 3. Stress in Planet and Ring

Christopher G. Cooley1 el Al [2] The dynamics and vibration of planetary gears and planetary gears is a practically important engineering problem with many technical challenges. Planetary gears have a well defined natural frequency and vibration due to their cyclic symmetry. With the complexity of the model (such as 3D effects, continuous elastic flexibility and gyroscope effects) to attract user rotation, this structure is durable. The forced response model of the planetary gear identifies the resonances of the fluctuations in the stiffness of the chain link and the non-linearity due to the separation of the teeth, which also occurs in the measurements of the real planetary gear systems. By suggesting an appropriate number of teeth to reduce the speed of the bond, some of the harmonics of the response disappeared. Experiments with planetary gears are even rare, and include complex phenomena that can occur, such as the vibration of elastic gears. Planetary gear measurements have an interesting spectrum that is related to the sideband frequency. Planetary gear models are becoming more realistic and complex, including, for example, elastic deformations of gears, gyroscopic effects and tooth changes. Research has addressed several manufacturing errors in planetary gears and how these errors affect the dynamic response. The tooth surface modalities used in almost all gears must be designed using a planetary gear model of the system using isolated solar planet models and pair of annular planets.

S. S. Sutar el Al [3] Try to use experimental and analytical methods to calculate holding or braking torque in epicyclic gear trains. The results are almost the same. Errors between analytical and experimental methods are due to mechanical and frictional losses that occur during the execution of the experiment. We have the ability to further validate experiments and analysis results in modeling software such as Catia, UG and solid works as future targets for this experiment.

The comparison of the results of the analysts and the experiments for the couple results in an error of 5.99% to 7.54%. This means that the efficiency of the experimental setup is used 100%.

There are some friction losses and mechanical losses. Several parameters influence the torque results, such as engine efficiency, friction losses that occur between the belt and the cable drum, the rigidity of the spring.

Shailesh Chaudhari el Al [4] To assess the strength and durability of the gearbox elements, a stress concentration factor is generally used. To optimize the weight of the solar gear and the pinion of the planetary gearbox, it is necessary to study the stress generated in the solar gear and the pinion. Review previous search permissions

The conclusion is the analysis of the solar pinion, the planetary pin and the planetary gear and the optimization of the planetary gear and the planet. Through the static analysis of the previous parts, all the parts are within the safety limits. In this case, the failure criterion used is von Mises's theory of stress, which shows that the piece is safe within the safety limit of the creep point of the piece material.

Mr. Patil P. B. el Al [5] Material handling plays a fundamental role in any department. Cranes are one of the most effective material handling equipment. A hoist is a device that lifts or lowers the load by means of a drum or a lifting wheel, and a rope or chain is wrapped around the hoist. However, at nominal loads under normal operating conditions and test loads under test conditions of up to 125% of the nominal load, many operators, as well as owners of cranes and cranes, worry that if the unit's motor It can cause a disaster. Damage broke. For some reason This may cause personal injury or death, property damage or loss of production time due to elevator downtime. Therefore, it is necessary to avoid a fail-safe system of the previously damaged engine. One way to solve this problem is to feed the power of two motors of the same level to the planetary gear. It is proposed that this system provide a double advantage to the existing single-engine system, that is, safety in case of failure of one of the engines. Dual speed unit so that multiple applications can be serviced by the same device.

ADARSH KUMAR el Al [6] During a critical review of the research on planetary gear trains and gearboxes, the following conclusions can be drawn: design parameters such as the number of teeth, the model, the number of planets, the width of the surface of the teeth, The modification of the shape of the tooth, the material Shaving capacity, life and cost are very important. In this way, trends and tensions can be

found under different loading conditions for existing ephemeral gearboxes. After the application of optimized technology, the weight of the planetary gearbox should be reduced. A limited element analysis should be done to verify that the optimal design of a planetary gearbox is safe. In the design of the planetary gearbox, it should be considered iteratively to make the composite structure have the least number of parts, greater transmission efficiency and greater load capacity. The multi-criteria mathematical modeling methods can be applied to planetary gears and the best set of Pareto solutions for different objective applications can be determined.

III. COMPONENTS OF EPICYCLIC GEARBOX

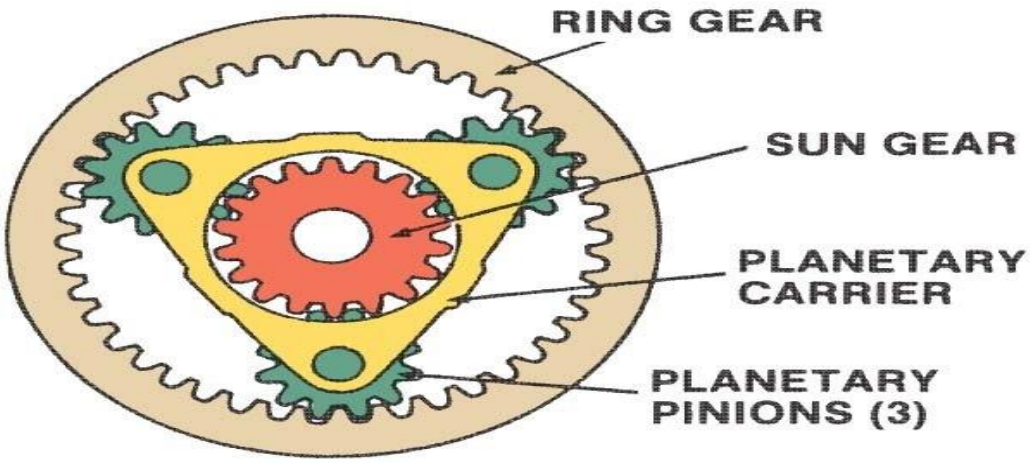

Fig. 4. Epicyclic Gearbox

1 **Ring gear-** It is a gear that looks like a ring gear. Its inner surface has angular incisors and is placed outside the planetary gear box. The internal teeth of the ring gear maintain a constant mesh with a group of planetary gears at the outer point.

2 **Sun gear-** It is a gear with beveled teeth in the center of the planetary gearbox; The solar gear maintains constant internal contact with the planetary gear and is connected to the input shaft of the planetary gear.

3 **Planet gears-** These are small gears that are used between the crown and the solar gear.The planetary gear shaft is connected to the planetary gear support, which carries the output shaft of the planetary gearbox.Planetary gears can rotate around their axis, or they can rotate between rings and solar gears like our solar system.

4 **Planet carrier-** It is a gear support connected to a planetary axis and is responsible for the final transfer of the output to the output axis. The planet's wheel rotates on the planet's vector and the revolution of the planet's wheel causes the rotation of the planet's vector.

5 **Brake or clutch band-** This equipment is used to repair the crown, sun gear and planetarium and is controlled by the brake or clutch of the vehicle.

IV. WORKING OF EPICYCLIC GEARBOX

The principle of operation of the planetary gearbox is based on the fact that one of the gearwheels (e.g., solar gear, planetary gear and crown) is fixed to obtain the torque or output speed. Items required Due to the previous configuration, a high torque is obtained at high speeds. The transmission ratio has changed. Let's see how we can get these reports.

A. First gear ratio

This provides a torque-to-vehicle ratio which helps the vehicle to move out of its original state and is achieved by repairing the gears, thereby rotating the carrier with the power supplied to the heater.

B. Second gear ratio

This provides a high speed relationship with the vehicle to help the vehicle reach higher speeds as you drive: these relationships are obtained by fixing the solar device, making the planetary carrier, and the element, a driving element. ring driving high-speed relationship to achieve.

C. Reverse gear ratio

This acceleration reverses the direction of the output shaft, which continuously transports the vehicle's direction. The device is disassembled by placing a planetary support, transforming the driver into a gear and a solar device.

V. ADVANTAGES OF PLANETARY GEAR SYSTEM

1) The planetary gear system can be used to ensure a higher transmission ratio in a compact space. That is why we prefer to use planetary gears in situations where speed reduction is required in a compact space.
2) For comparable transmission ratios, the planetary appliance system is lighter than normal transmission.
3) The power transmission efficiency will be relatively good compared to traditional gearboxes. A greater part of the energy supply will be provided using this leverage scheme.
4) The planetary gear system will have greater torque transmission capabilities and less inertia.

5) As we can see here, the transfer charge will be distributed on multi-system gears, so the load distribution will be very good and the torque transfer will also be increased through the use of planetary gear transmission.
6) For planetary gear systems, the guiding and guiding elements are concentric, so the guiding and guiding equipment can be installed on the same line, saving space.
7) For planetary gear systems, the guide and guide elements are concentric so that guides and guide devices can be installed on the same line, saving space.
8) The quality of service is also good compared to the traditional life of gear boxes for a uniform load.

VI. DISADVANTAGES OF PLANETARY GEAR SYSTEM

1) Compared with traditional gearboxes, the cost of gear systems can be high.
2) The design and manufacture of planetary appliance systems is very complex
3) It is difficult to determine the effectiveness of planetary gear systems.
4) Firstly, the ratio of debt to equity must be accurate
5) Some planetary gear specifications generate additional noise during use.
6) To avoid leverage, the guide limb

VII. CONCLUSION

The result of this paper is a very compact planetary gear reducer designed for the Formula Student electric vehicle. We went through an iterative design process and all mechanical transmission components were carefully inspected and studied to achieve the lightest possible design. The report is an important study of the long-term vision of cars for Formula students. In this project, the design and analysis of the gearbox were carried out under static load and wear angles, taking into account the best lightweight design. Lubrication mechanisms and lubricants and bearings suitable for the gearbox have also been selected.

VIII. REFERENCE

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