

3D Printing of Planetary Gear Which Is Used In Clock Mechanism

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ABSTRACT: 3D PRINTING is also known as additive manufacturing. Construction of the part or assemble is usually done using 3D PRINTING technology. With the use of this technology we can create and print functional end usable parts directly from our office, home, collage or any other place with the help of computer and 3D printing machine. The use of 3D PRINTING is becoming more popular in mechanical industries, ornaments and jewellers making industries, medical, educational institutes, fashion industries, food industries, for creation of new models and for many other purposes. This project deals with design, analysis and manufacturing of prototype of complex virtually unlimited internal and external geometry of planetary gear wheel which is used in clock mechanism by using the technology of 3D printing.

KEYWORDS: Designing, Analysis, and Manufacturing.

I. INTRODUCTION

A Planetary gear train comprises of one or more planet gears, revolving about a sun gear. Planetary gears have become popular in 3D printing for few different reasons. The reason is planetary gearing system is employed to achieve high reduction ratio in small and power dense package and it is smaller and light in weight. These gears are extensively used for transmission and are most critical components in a mechanical power transmission system. The largest use of 3d printed planetary gear system is in toy industry for kids and it is also wildly used in industry, such as paper industries, wind mills, and sugar industries. Planetary gears have been in motion for many years. The advantages are the higher torque capacity, smaller size, lower weight and improved efficiency characteristics of a planetary design. The small size and modular construction of planetary gearboxes also means that they can be assembled in several stages, providing high reduction capability from a highly compact package. And it can be wildly used in industry, such as printing lathe, automation assembly and sugar industry.

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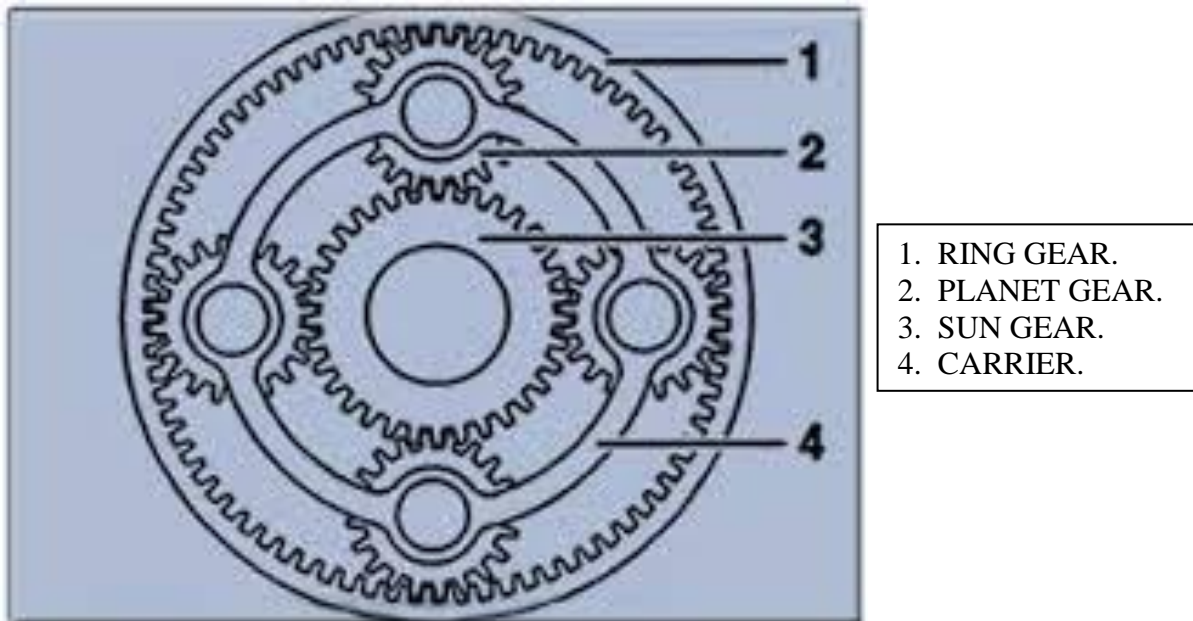


FIG:1. IMAGE OF PLANETARY GEAR

II. MATERIALS AND METHOD USED

To design the model of planetary gear CAD software CATIA V5R20 is used and to analysis the model ANSYS R15 is used and to manufacture the model 3D printer is used by using ABS material with the help of all these material and method we can show the mechanism of the planetary gear in clock mechanism.

III. SCOPE OF PROJECT

This project helps in getting knowledge and awareness of use and eases of 3D printing techniques to us and others. With this knowledge we can design new models in many fields like medical, educational institutes, fashion technology, manufacturing industries, food industries and many more.

IV. PROPOSED METHODOLOGY AND DISCUSSION

In this project we deal with three different stages to get the proto type that we require,

1. Design,
2. Analysis and
3. Manufacturing.

1. Design.

Designing of the model of planetary gear is done by using advanced CAD software CATIA V5R20.

CATIA stands for Computer Aided Three-dimensional Interactive Application. It is the most powerful and widely used CAD (computer aided design) software of its kind in the world.

CATIA is owned/ developed by Dassault Systems of France and until 2010, was marketed worldwide by IBM. When we look around us, anything and everything we see had to be designed before it could be manufactured. The pen on our desk, our desk, and the chair we are sitting in, our appliances, our automobile, etc. The list is almost endless. Today, nearly all products are designed on computers. Computers are even designed on computers.

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CATIA plays a major role in the design process. In mechanical engineering CATIA enables the creation of 3D parts, from 3D sketches, sheet metal, composites, molded, forged or tooling parts up to the definition of mechanical assemblies.

The software provides advanced technologies for mechanical surfacing. CATIA offers a solution to shape design, styling, surfacing workflow and visualization to create, modify, and validate complex innovative shapes. CATIA supports multiple stages of product design whether started from scratch or from 2D sketches.

To design this model we need some input parameters which are shown in table.1

	SUN GEAR	PLANET GEAR	RING GEAR
QUANTITY	1	3	2
NUMBER OF TEETH	24	36	96
PRESSURE ANGLE	20°	20°	20°
PITCH DIAMETER	24mm	36mm	96mm
ADENDUM FULL DEPTH	1.0m	1.0m	1.0m
STUB	0.8m	0.8m	0.8m
DEDENDUM FULL DEPTH	1.25m	1.25m	1.25m
STUB	1.0m	1.0m	1.0m

TABLE: 1. INPUT PARAMETERS FOR CAD DESIGN.

2. Analysis.

Analysis of the model is done by ANSYS R15 software. ANSYS is a general purpose software, used to simulate interactions of all disciplines of physics, structural, vibration, fluid dynamics, heat transfer and electromagnetic for engineers. So ANSYS, which enables to simulate tests or working conditions, enables to test in virtual environment before manufacturing prototypes of products. Furthermore, determining and improving weak points, computing life and foreseeing probable problems are possible by 3D simulations in virtual environment. ANSYS can import CAD data and also enables to build geometry with its "preprocessing" abilities. Similarly in the same preprocessor, finite element model (a.k.a. mesh) which is required for computation is generated. After defining loadings and carrying out analyses, results can be viewed as numerical and graphical. ANSYS can carry out advanced engineering analyses quickly, safely and practically by its variety of contact algorithms, time based loading features and nonlinear material models. To analysis the model we need some input parameters like angular velocity, moment etc.

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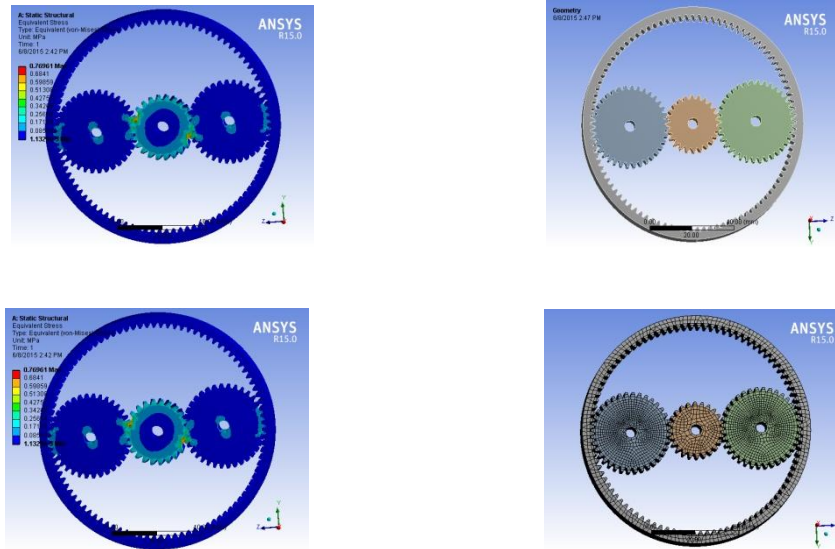


FIG:2. ANALYSIS OF GEAR USING ANSYS

3. Manufacturing.

Manufacturing of planetary gear is done by using 3D printer. 3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the entire object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual object. It all starts with making a virtual design of the object you want to create. This virtual design is made in a CAD (Computer Aided Design) file using a 3D modeling program or with the use of a 3D scanner. A 3D scanner makes a 3D digital copy of an object. Here to print (manufacture) the models by using the 3d printer we need to convert CAD file to STL file format so the input parameters for printing the models are CAD drawings in STL format.

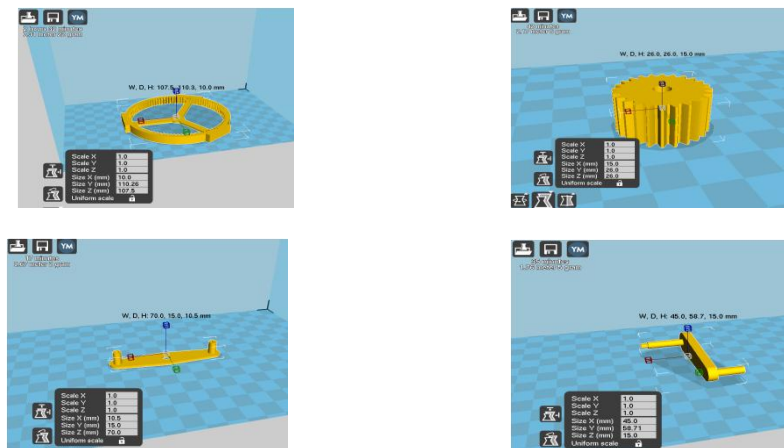


FIG: 3. INPUTS FOR 3D PRINTER TO MANUFACTURE THE MODEL IN STL FORMAT.

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V. FUTURE SCOPE

There are several future recommendations that should be considered. When we are designing the gear we need to consider the numbers of teeth, pitch, gear ratio, addendum, dedendum etc to avoid problems such as wear, not rotating, no movement etc. And when we are manufacturing the part using the 3d printing machine we need to put back up power for it, or else we need to reprint the part if the power gets switched off in between the part manufacturing.

VI. CONCLUSION

In conclusion, the model that is design and manufactured is in working state, that is, the planetary gear which manufactured using CAD software (CATIA V5R20) to design, ANSYS R15 software to analysis and 3Dprinting techniques to print the model, to show the mechanism of clock is able to work with the desired functions. This prototype of planetary gear can be applied to the clock mechanism in real time with the same values or they can also change the dimensions with their requirements by using this procedure as guidelines.

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BIOGRAPHY



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