3D PRINTING AND ANALYSIS OF LEAF SPRING

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ABSTRACT: 3D printing is an additive manufacturing process that can build objects directly from a computational model. Not in the slightest degree like standard gathering procedures, for instance, handling and embellishment, 3D printing can fabricate models of self-assertive intricacy in somewhat quick time spans. It is an integral asset for picturing complex human or creature life systems and can be utilized for careful preparation, doctor and patient schooling, operation preparing, clinical gadget prototyping, and customized clinical gadget fabricating.3D printing innovation is quickly developing with progresses in materials, goal, and speed thus creating greater realism and higher accuracy; this in turn enables new medical applications. A leaf spring is a most ordinary kind of spring used for suspension in significant vehicles. It is consists of different strips bended somewhat upwards and joined together one over the other. These plates are joined to the body casing and hub of vehicle. The suspension framework in a vehicle is critical to improve the riding solace and dependability of the vehicle

Keywords: 3D Printing, Leaf spring, CATIA V5, Ansys.

1.INTRODUCTION

1.1 3D PRINTING TECHNOLOGY:

3D Printing also called as an Additive Manufacturing is a method of fabricating three dimensional solid objects from a digital file.3D printing is an additive process whereby layers of material are built up to enable a 3D component. This is the contradict of subtractive manufacturing processes, where a final design is cut from a larger block of material. As a result, 3D printing enables less material wastage. The creation of a 3D printed object is achieved using the additive process. Objects can be a almost any shape or geometry, and are produced from a 3D model or other electronic data source. 3D printing is also accurately suited to the creation of complex, bespoke items, making it ideal for rapid prototyping.

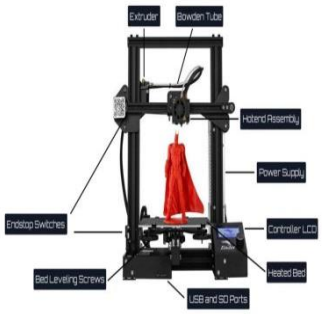

Fig-1: 3D printer

1.2 What Materials can be used in 3D Printing?

There are a range of 3D printing materials, including thermoplastics such as acrylonitrile butadiene styrene (ABS), metals (including powders), resins and ceramics.

1.3 Fused Deposition Modelling:

The interaction begins with the stacking of the spool of thermoplastic fiber. These thermoplastic fibers (clarified later in the article) are the material for FDM printing. This fiber goes to the extruder when the temperature of the print head arrives at the softening mark of the particular fiber. The temperature will vary according to the determination of the materials in FDM 3D printers. You should have a plan prepared for printing. As indicated by the 3D plan, the print head moves in all around the different pivot. Presently, as the expulsion head is stacked with the dissolved thermoplastic material, the testimony initilializes with the development of the expulsion head. One layer later the other, the material is stored according to the 3D plan that has been inputted in the FDM 3D printer. Later each layer, the cooling of thermoplastic material happens utilizing the cooling fans that are joined to the expulsion head. Later each layer finishes, the form stage drops down giving space for the following layer affidavit. The following layer comes over the past one and the whole interaction proceeds until the total 3D part is printed out of the machine.

1.3.1 FDM 3D Printing in Practice

FDM is more user-friendly than the other two methods, and it has fewer working parts to contend with. It's likewise more reasonable, making it the most famous technique for work area 3D printers. In addition to

carrying a lower price tag, the thermoplastic filaments are also environmentally and mechanically stable. Notwithstanding, printing an article with FDM by and large takes longer than printing a similar item utilizing SLS or SLA, and the eventual outcome will require some modifying. FDM often produces objects with rougher surfaces.

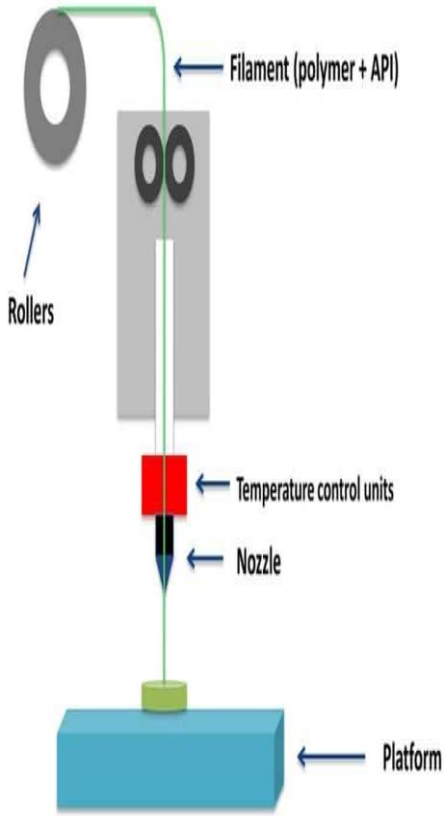

Fig -2: FDM machine

1.3.2 Printing

The powder is scattered in a slight layer on top of a stage within the form chamber. The printer preheats the powder to a temperature to some degree underneath the softening place of the unrefined substance, which makes it simpler for the laser to raise the temperature of specific regions of the powder bed as it traces the model to solidify a part. The laser checks a cross-part of the 3D model, warming the powder to simply beneath or right at the dissolving point of the material. This breakers the particles together precisely to make one strong aspect

1.3.3 Cooling

In the wake of printing, the form chamber needs to marginally chill off inside the print fenced in area and then, at that point, outside the printer to guarantee ideal mechanical properties and try not to twist in parts.

1.3.4 Post-processing

The completed parts should be eliminated from the form chamber, isolated, and cleaned of overabundance powder. The powder can be reused and the printed parts can be further post-handled by media impacting or media tumbling.

2. LEAF SPRING

2.1 INTRODUCTION

The leaf spring ought to assimilate the upward vibrations and effects because of street inconsistencies through varieties in the spring diversion with the goal that the potential Energy is put away in spring as strain energy and afterward delivered gradually. Weight decrease has been the fundamental focal point of car makers in the current situation. Weight decrease can be attained essentially by the presentation of better material, plan improvement and better assembling measures. The suspension leaf spring is one of the expected things for weight decrease in autos as it represents 10% - 20% of the unsprang weight.

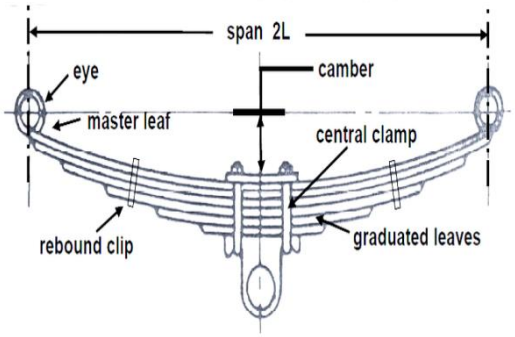

Fig -3: leaf spring

2.2 TYPES OF LEAF SPRINGS

1. Semi Elliptical leaf spring

2. Elliptical leaf spring

3. Quarter Elliptical leaf spring

4. Transverse leaf spring

5. Three Quarter Elliptical leaf spring

Based on the number of plates we have taken a brief look at the two different types of leaf spring out there and how they work

1. multi leaf spring
2. Mono leaf spring

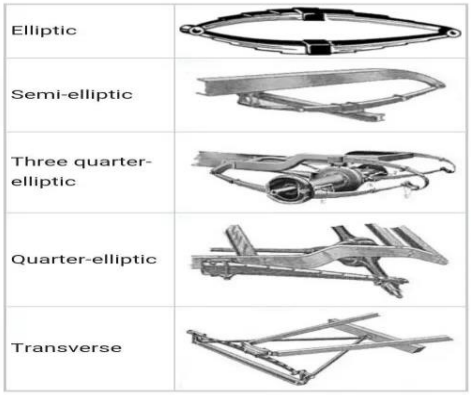

Fig 4: Types of leaf spring

3. MATERIAL SELECTION

Nearly 60-70% of the vehicle price is mostly invested in materials used in the vehicle and contribute to the efficiency and the performance of the vehicle. Smaller quantity of weight reduction also affects the impact of economy. The best suitable alternates to the convention structural steel used mostly in all automobiles is Composite materials. These also affects the weight reduction of the vehicle which also increases the efficiency of the vehicle. So, the composite materials have been used for Leaf Spring design is High Carbon steel AISI 1080 and the design parameters are selected and analyzed with the goal of reducing weight of Composite Leaf Spring.

4. LITERATURE SURVEY

[1] Brogan Rylands and et.al In his paper "3D printing used for printing or not" It is collaborative attempt across the whole organization and there are many aspects to be considered, stemming not only from a business and technical perspective but also social and environmental aspects that require consideration. This review provided an overview of what 3D printing is, examples of industries that it is currently deployed in, how it can influence supply chains and aspects for consideration before adoption of 3D printing. It highlighted the need for increased awareness and collaboration in the area and future challenges and opportunities in 3D printing.

[2] ALEXANDER Pirjan and Dane-Mihaela Petrosanu, In his review paper "On 3D printing aspects and various processes used in 3D printing or additive manufacturing (AM) is a process for making a 3D object of any shape from a 3D model or other electronic data sources through additive manufacturing processes in which successive layers of material are laid down under computer controls. Hideo Kodama of Nayoga Municipal Industrial Research Institute is generally regarded to have printed the first solid object from a computational design.

[3] Vinod G. Gokhare There are many companies that have established their foundation in 3D printing industry such as Stratsys and MakerBot. These companies have established partnership with many Indian companies in order to boost up their customer base. Key part dynamic in India 3D printing market (counting makers and wholesalers) space are Altem Technologies, Imaginarium, Brahma 3, KCbots, and bJGroup Robotics. The above said players are re-imagining their existing supply chains by networking printers where logistics may be more about delivering digital design files from one continent to printer farms in another. In the last 12 months, India has seen a transformation in the 3D printing industry with the emergence of local 3D printer manufacturers.

[4] Francesco A noni, Bargain & Eduardo Sabiana-In this journal the authors have designed and optimized a new leaf spring suspension and proposed leaf spring suspension weights.

[5] Noma shumai, Dawood Rezaei-The authors explained about behavior of an optimized composite leaf and four steel leaf spring has been Analyzed, compared under stress and displacement constraints.

[6] MD Tahsin Ishimaru & Sung Hwan Jo-Both Done Analysis Of spring steel through Ansys Software CAD workbench by proving Factor of safety, Reduced Deformation, Fatigue Life and other parameters has been resulted by CAE Analysis.

5. DESIGN OF LEAF SPRING BY USING CATIA V5

- The leaf spring that is to be printed first.Then,by selecting one of the three planes,the following

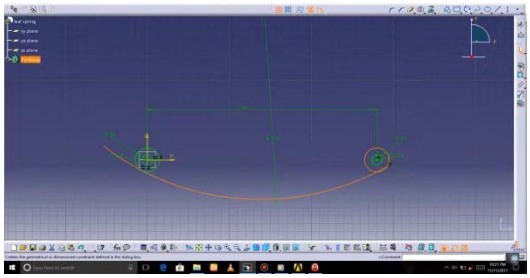

Fig 5: CATIA(sketch 1)

- Extrude the 2d figure for 12.5mm

Fig 6: CATIA (extrude command 1)

- Using the extrude command the second leaf upon the first one

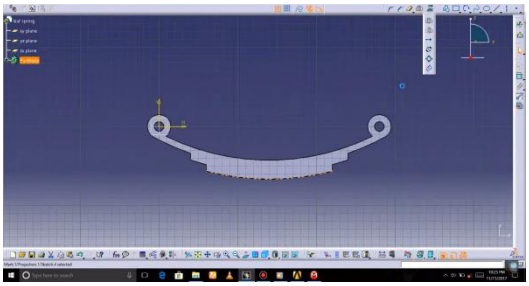

Fig 7: CATIA (sketch 2)

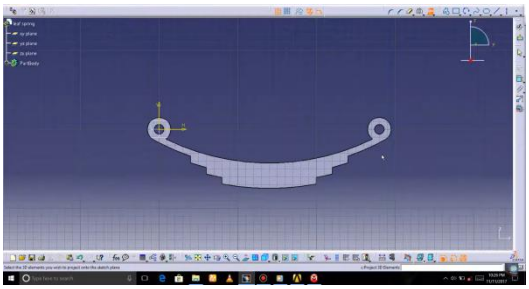

Fig 8: CATIA (extrude command 2)

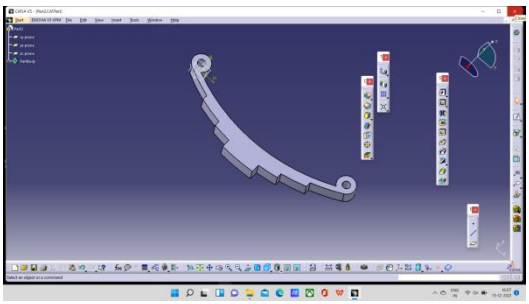

Fig 9: CATIA 3d model of leaf spring

The slicing is Repetier host software after the design is completed in Catia V5 the design is send the dimension is decreases accord to design after completion of slicing the estimate is given there. After that the code is copy through the sd card and the codes is copied by the 3d printer.

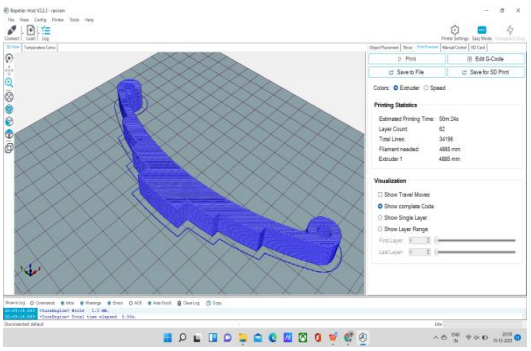

Fig 10: Slicing

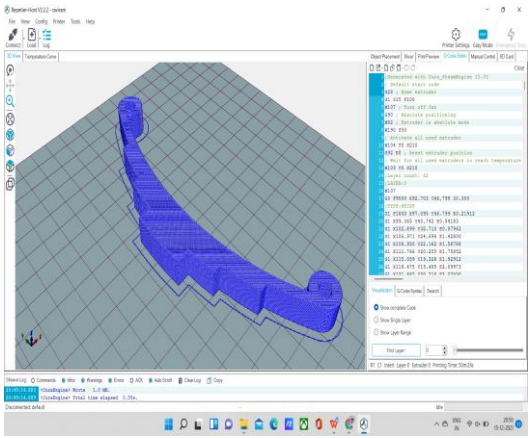

Fig- 11: Codes

6. ANALYSIS OF LEAF SPRING

In ANSYS Software there are many analysis systems such as design assessment static structural static state thermal, transient structural etc. here we are using static structural analysis.

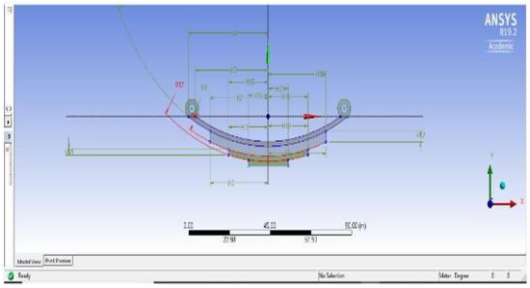

Fig-12: Static analysis

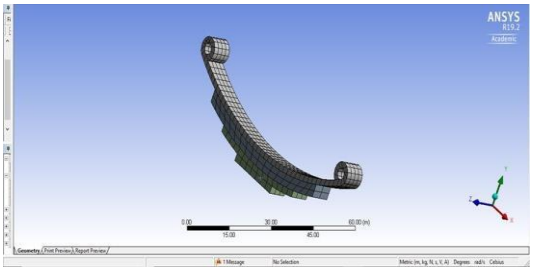

Fig -13: Meshing

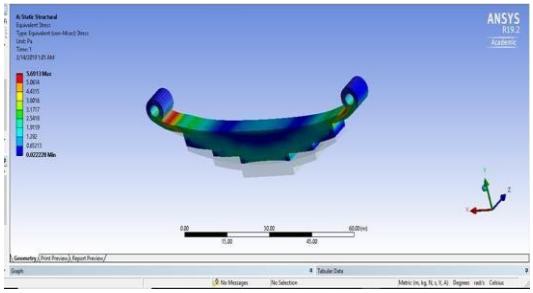

Fig 14: Stress

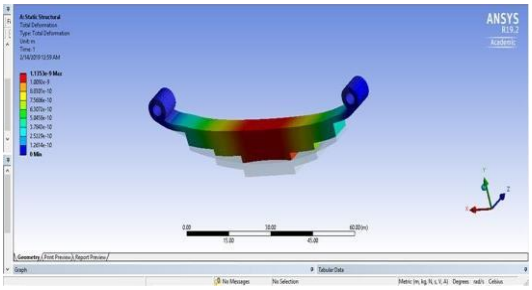

Fig 15: Deformation

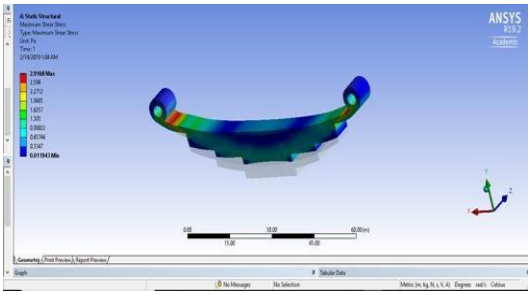

Fig -16: Shear stress

PARAMETER	VALUE
MATERIAL SELECTED	High carbon steel
YOUNG'S MODULUS, E	190-210 GPA
POSION'S RATIO	0.27
BULK MODULUS	160 GA
DENSITY	7.7-8.03Kg/m^3
THERMAL CONDUCTIVITY	48.1 W/make
TENSILE STRENGTH ULTIMATE	965MPa
TENSILE STRENGTH YEILD	585MPa
BEHAVIOUR	Isotropic

Design Dimensions

- Materials selected:high carbon steeel
- Master spring length:2000mm
- Intermediate spring length:1800mm
- Bottom spring length:1600mm
- Radius of curvature:3500mm
- Thickness of spring:15mm
- Width of spring:70mm
- Major arc angle:180+40=220 degrees

7. Conclusions

In this paper, we presented the idea and implementation of a feedback control system for a specific Additive manufacturing process. The feedback control is based on measurements taken during the process and aims at reaching a specific desired stiffness for an object comparable to a leaf spring. A better precision was achieved using a closed- loop control with filtering than by using two baselinesa closed-loop control without filtering and an open-loop control. This experiment, while very specific and hardly eneralizable as it is, shows the relevance of feedback control

in AM. One may argue that what makes this experiment successful is not directly related to the fact that AM is used for manufacturing the final part. But even if a similar experiment could certainly be imagined without using a 3D printer but with another process instead, the material requirements would have been limiting and the whole process more complicated and time-consuming. The field of AM is appealing because of the simplicity it offers for manufacturing complex and various parts quickly. And we think that could benefit from the introduction of closed-loop control systems based on widespread methods coming from subfields of optimal control such as stochastic optimal control and filtering. The use of dynamic programming and better control algorithms in general, based on the expected characteristics of an object and nondestructive testing, could leverage the potential of low-cost printers to produce high-quality prints.

To generalize this experiment to different processes and desired object properties, a general framework to describe various object properties and link them to control variables is required. Moreover, nondestructive testing technologies such as computed tomographscanning or ultrasonic testing have to be better integrated with 3D printers to perform in-situ measurements during printing. Hence we found that the high carbon steel is better than the alloy steel and more effective and beneficial for the passsenger vehicles. And the design is safe.

8. REFERENCES:

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