

USE OF RAPID PROTOTYPING TECHNOLOGY IN MECHANICAL INDUSTRY

Ajinkya V. Maknikar¹

Student, Department of mechanical engineering, IGTR, Maharashtra, India

Abstract - In the new product design and development process, it is necessary to produce single prototype before allocation of large amount of money to new assembly line of dies. The cost is very high and production takes time to prepare. Rapid Prototyping (RP) is quickly producing a model of component using 3-dimensional computer aided design data (CAD). It is also called as Solid Freeform Fabrication (SFF). This prototype is being used in different fields like automobile industries, medical application, arts. This technology enables large productivity gains in prototyping and significant reduction of development times from system concept to operation.

Key Words: prototyping, CAD, product design.

1. INTRODUCTION

Rapid Prototype (RP) is the name given to a process that produces 3D objects direct from a CAD model by using layer by layer method. Its introduction in 1986. By means of this technology make component in just few hours, from CAD file in which geometry of the model is defined in 3D. Nowadays the product manufacturing industries has given more importance to product development phase. Therefore Rapid prototyping Technology plays the vital role in a product development. It has been high prospective to minimize time and cost of product development. It is the important thing in digital manufacturing in rapid product development. This prototype can make those complex shapes which not easily seen or understood in the drawings. It gives the designer the possibility of verifying the shapes of the product. It cuts down the required time to design the product. The methods of Rapid Prototype are used for manufacturing the component such as Selective Laser Sintering (SLS), Stereo Lithography (SLA), Laminated Object Manufacturing (LOM), Fused Deposition Modeling (FDM), Multi Jet Modeling, 3D printing.

Rapid Prototype systems join together liquid, powder and sheet material to form parts. Layer by layer, the RP machines fabricate these powdered ceramic, wood, plastic and metal powders using very small and thin horizontal cross sections of the generated computer component.

Types of Rapid Prototype method –

❖ Solid base method

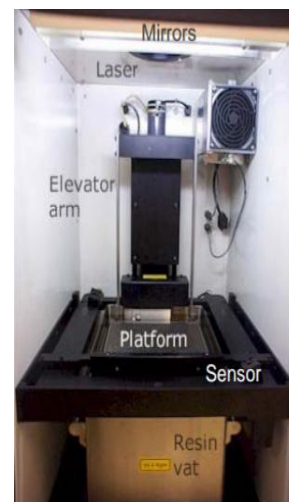
1. Fuse Deposition Modeling (FDM)
2. Laminated Object Manufacturing (LOM)
3. Multi Jet Modeling

Liquid base method finally, completes content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

1. Stereo Lithography (SLA)
2. Solid Cubical Ground (SGC)

❖ Powder base method

1. Selective Laser Sintering (SLS)
2. Laser Engineering Net Shaping (LENS)
3. Direct shell production casting (DSPC)



- Laser** – concentrative UV beam to transom liquid resin into solid state.
- Elevator** – control the movement of platform upward and upward in order to
- Platform** – a steel plate with plenty of holes as the basement for part building
- Resin vat** – contain raw material to form SLA model
- Mirrors** – control the path of movement of the laser beam at X and Y axis
- Sensor** – locate the coordinate and instant power of the laser beam and feedback to the control unit for fine adjustment

2. LITERATURE REVEIW

The Rapid Prototyping (RP) is a new forming process which fabricates physical parts layer by layer under computer control directly from 3D CAD models in a very short time. The different rapid prototyping techniques are commercially available. A software 'slice' the CAD model into number of thin layers (~0.1 mm), which are then made up

one atop another. Rapid Prototyping is a additive process, combining layers of paper, wax, or plastic to create a solid object. To make a final component machining process (milling drilling, grinding, etc) is needed but in Rapid prototyping (RP) additive nature allows it to create objects with complicated internal features which can not be made by machining process. Most prototypes require three to seventy two hours to build, depend on the size and complexity of the object. Initial investment is very high for simple shaped metals parts required in large quantity; conventional manufacturing techniques are usually more economical.

3. OBJECTIVE OF THE PROJECT

The main purpose of this paper is to create awareness about product developments and manufacturing the model with the aid of computer modeling among the industrial people, researchers, student community, and also the application of RP model developments in various fields. This paper reveals that the challenges associate insight in Rapid Prototyping and the factors to be considered while developing Rapid prototyping techniques in Indian scenario.

4. METHODOLOGY

Rapid Prototyping (RP) by layer-by-layer material deposition in which form is shaped by material removal. In all commercial RP processes, the part is fabricated by deposition of layers contoured in a (x-y) plane two dimensionally. The third dimension (z) results from single layers being stacked up on top of each other, but not as a continues z- coordinate. Therefore, the prototypes are very exact on the x-y plane but have stair -stepping effect in z -direction. If model is deposited with very fine layers, model looks lie original.

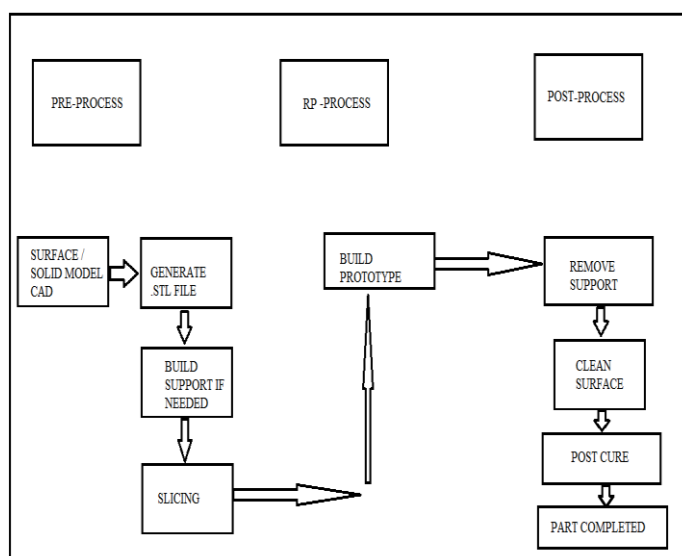


Figure. 1 shows the whole process.

The process is divided in three stages:

First stage:-

It is a pre process. It is on modeling in the computer by means of bi dimensional CAD software, making the necessary section, sketches and all details for correct understanding. It is not necessary to start with 2D model, but it is helpful in making 3D CAD models during the creation of solid model. Once 3D model complete, it should be saved in STL file (stereo lithography format). The file will generate a fact model and finally the model is sent to be built.

Second stage: -

It is Rapid prototyping process. This stage is on detailed design .At this point it is possible to achieve directly the 3D model or by successive approaches building intermediate models with rapid prototyping, until designers obtain the desired model.

Third stage: -

It is post process. In this process, once the final product get completed. It will take some time to cool down and then supportive part of the product gets removed and cleaned the surface.

5. FACTORS TO BE CONSIDERED WHILE DEVELOPING RP TECHNIQUES

The following are the challenges associate insight in rapid prototyping. The RP models are manufacturing directly from the computer aided design model with automated machine. Hence, the following are to be considered for developing the RP system.

- Develop automatic recognition of appropriate geometric features from the STL file, such as; minimum wall thickness
- Develop the rules relating to prototyping metal components.
- Improve the user definition or classification of prototype use.
- Investigate which method of delivery best answer the needs of small companies and who would be responsible for its upkeep
- Create a full system in a native programming environment suitable for delivery in the manner identified.

6. FACTORS TO BE CONSIDERED WHILE DEVELOPING RP TECHNIQUES

- Initial cost
- Availability of trained man power

- Material
- Awareness of RP techniques
- Knowledge of 3D modeling
- Programming language
- Awareness of RP techniques
- Reality of the model
- Knowledge in the 3D modeling
- Selection of Modeling software

7. CONCLUSION

The use of Rapid prototyping technology is essential in any design fields. It was conceived as a arts, medical, architecture application, the mechanical field also take benefit from this technology. This technology can make complex shape model which can not made by machining process (drilling, milling, etc) and to create awareness about product developments and manufacturing the model with the aid of computer modeling.

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