Reverse Engineering in Mechanical Component

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Abstract:- **The project is about application of reverse engineering. Reverse engineering helps in obtaining the geometry of part or product which is not available otherwise. Currently this part is not available in the market as it is out dated and drawing of the component does not exist. As the part is no longer available it has to be made in-house so it will require all activities from designing to rapid prototyping. The part geometry is first obtained with the help of scanning technology. Then with the use of different soft wares the three dimensional image of the broken impeller is obtained. Once the image is obtained the part is optimized using solid works, CAD software. After the optimized geometry is obtained, the pattern of the part is obtained using Rapid prototyping machine. This can be used for casting of the original part.**

Keywords— Reverse engineering; Laser scanning; Solid works; Computational fluid dynamics; Rapid prototyping

INTRODUCTION:

Engineering is the profession involved in designing, manufacturing, constructing, and maintaining of products, systems, and structures. At a higher level, there are two types of engineering: forward engineering and reverse engineering. Forward engineering is the traditional process of moving from high-level abstractions and logical designs to the physical implementation of a system. In some situations, there may be a physical part without any technical details, such as drawings, bills-of-material, or without engineering data, such as thermal and electrical properties. The process of duplicating an existing component, subassembly, or product, without the aid of drawings, documentation, or computer model is known as reverse engineering.

TYPES OF REVERSE ENGINEERING:

I) SOFTWARE REVERSE ENGINEERING:

Software reverse engineering is done to retrieve the source code of a program because the source code was lost, to study how the program performs certain operations and also to improve the performance.

II) HARDWARE REVERSE ENGINEERING:

Hardware reverse engineering involves taking apart a device to see how it works.

III) 3-D WIRE FRAME IMAGE:

Another type of reverse engineering involves producing 3-D images of manufactured parts when a blueprint is not available in order to remanufacture the part. To reverse engineer a part, the part is measured by a coordinate measuring machine (CMM). As it is measured, a 3-D wire frame image is generated and displayed on a monitor. After the measuring is complete, the wire frame image is dimensioned. Any part can be reverse engineered using these methods.

PRODUCT DEVELOPMENT APPROACH:

1.CONVENTIONAL

Starts with the geometric modeling utilizing a CAD system. The geometric model could be represented as a wire frame or as surfaces or as a solid structure.The generated CAD information could be exported subsequently in standard format and imported in the same data format to CAE systems and/or to CAM systems (allowing to generate tooling trajectories—NC-code).

2.NON-CONVENTIONAL

Used when the physical product is available, but no CAD data is available. Therefore, need toCapture the geometry of parts/molds/tools (or prototypes). Generate a conceptual numerical model that will be used in CAE and CAM systems. This process is called Reverse Engineering.

PROCESS OF REVERSING PART:

In order to reverse engineer a product or component of a system, engineers and researchers generally follow the following four-stage process: shown in Fig.1.1.

- Identifying the product or component which will be reverse engineered
- Observing or disassembling the information documenting how the original product works
- Implementing the technical data generated by reverse engineering in a replica or modified version of the original

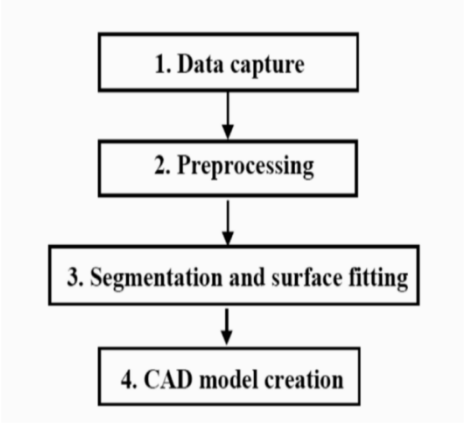


FIG.1.1

In the first stage in the process, sometimes called "pre-screening," reverse engineers determine the candidate product for their project. Potential candidates for such a project include singular items, parts, components, units, subassemblies, some of which may contain many smaller parts sold as a single entity.

The second stage, disassembly or de-compilation of the original product, is the most time-consuming aspect of the project. In this stage, reverse engineers attempt to construct a characterization of the system by accumulating all of the technical data and instructions of how the product works.

In the third stage of reverse engineering, reverse engineers try to verify that the data generated by disassembly or de-compilation is an accurate reconstruction of the original system. Engineers verify the accuracy and validity of their designs by testing the system, creating prototypes, and experimenting with the results.

The final stage of the reverse engineering process is the introduction of a new product into the marketplace. These new products are often innovations of the original product with competitive designs, features, or capabilities. These products may also be adaptations of the original product for use with other integrated systems, such as different platforms of computer operating systems. Main Concepts of Manual Reverse Engineering:

MAIN CONCEPTS OF MANUAL REVERSE ENGINEERING:

Manual reverse engineering can be described as the form of RE that does not uses any machine to take the dimensions of the component in concern. A particular sequence of steps then has to be followed to reverse engineer which is as follows.

1. PRODUCT DISSECTION

First step is to take apart the subject throughout. All the parts has to be taken apart of that subject without causing any damage to any part without forgetting their arrangement.

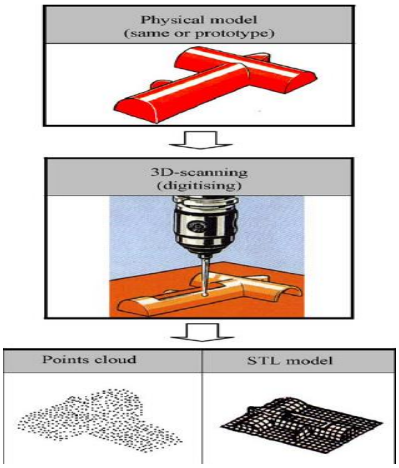
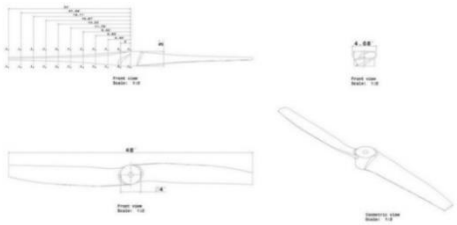


Fig.1.2

2. MEASUREMENTS WITH ROUGH DRAWING

All the dimensions have to be recorded of all the parts of the disassembled subject on a rough drawing of all the respective parts. These should be good enough to be easily understood by the user. The rough drawing serves a great purpose while creating their 3D model on any CAD software.



3. 3D MODELLING

After recording all the dimensions, last step is to create the 3D CAD model on any software. Several software are available now a days to allow easy modelling of the subject. Different parts can be modelled separately and finally while creating the complete model. All the different part models can be assembled together as one. In any assembly drawing, it is highly convenient to show the exploded view of the complete subject so that it becomes easy to understand the assembly.

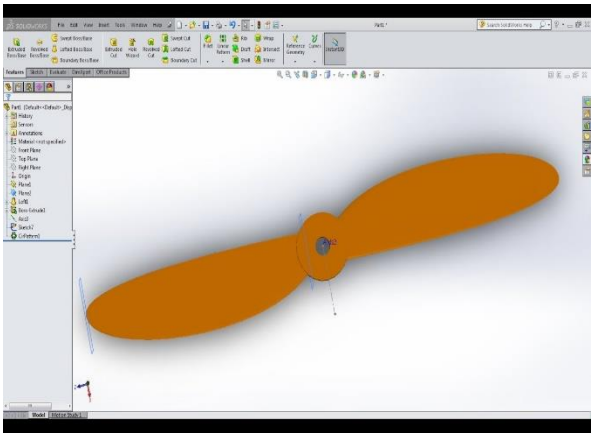
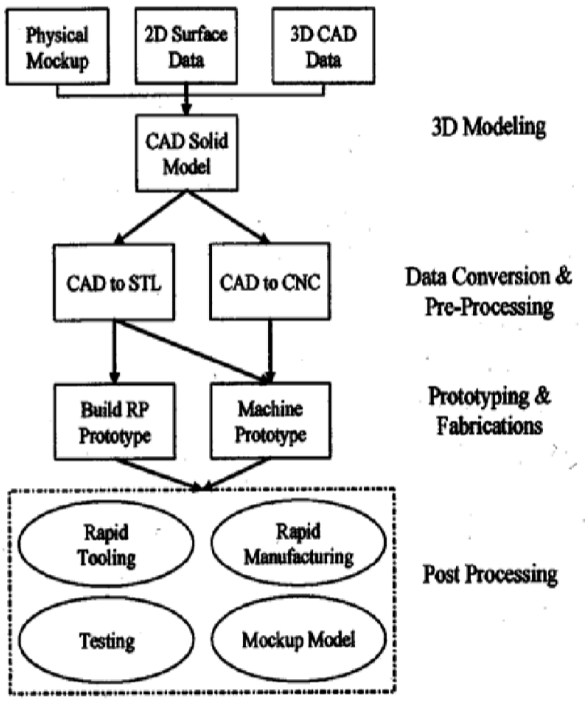


Fig.1.4

Fig.1.6

4. RAPID PROTOTYPING:



Rapid Prototyping refers to the fabrication of three dimensional physical models directly from a computer-aided design. The advantage of building a part in layers is that it allows you to build complex shapes that would be virtually impossible to machine, in addition to more simple designs. Rapid Prototype can build intricate internal structures, parts inside of parts, and very thin-wall features just as simple as building a cube. All the Rapid Prototype processes (Fig.1.5) construct objects by producing very thin cross section of the part, one on top of the other, until the solid physical part is completed. This simplifies the intricate three-dimensional construction process in that essentially two-dimensional slices are being created and stacked together. Models can usually be built within hours, and the build materials for most processes are inexpensive. Some Rapid Prototype machines are small and environmentally friendly so they can be placed into a designer's office.

APPLICATIONS:

- It may be necessary to produce (or modify) a part when no original drawings or specifications of components are available.
- In some cases, stylists use full-scale wood or clay model. Once these physical models are ready, they are reverse engineered to get the CAD model for many downstream activities

CONCLUSION:

The work done till now shows how reverse Engineering can be used for worn out or broken parts whose availability is a problem, in such cases as there is no any documentation or drawing available prior so everything has to be done from the starting phase. Reverse engineering plays a vital role in providing a digital data for CAD CAM & CAE applications. As the basic data is recovered by Reverse Engineering process it can be used further for different procedures. In this method the main advantage is that once we get the CAD model of the component it can be used for analysis and design optimization which proves to be beneficial in developing any product from market point of view. Also reverse engineering can be used in combination with Rapid Prototyping for obtaining the model which can be used for further manufacturing of original product. A Rapid prototype model helps in visualization and better understanding of final product.

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