RESEARCHERID
THOMSON REUTERS

ISSN: 2277-9655
[E Madan Manohar, 6(12): December, 2017] Impact Factor: 4.116
IC™ Value: 3.00 CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

A CASE STUDY ON DESIGN OF THE COMPONENT FOR COMPLEX SHAPES USING REVERSE ENGINEERING.

E. Madan Manohar*

*Technical Officer, CAD Department, CIPET Jaipur

DOI: 10.5281/zenodo.1116622

ABSTRACT

The paper describes about the state of art technology in preparing the existing component using digitized data by using optical scanners. Whereas the copy milling and CMM process was a traditional process by which the data could not be generated for creating a CAD model with precise accuracy. The study also in visages how to generate the Cloud point data and how it can be converted into CAD model for the given product using Polyworks software. The CAD file formats (i.e. ply & STL) i.e. cloud point data conversion which is generated by using white light scanner was further investigated with the other reverse engineering software's such as Image ware and Polyworks. The digitization process for the given component was developed using the Breuckmann OPTOCAT White light scanner. The modeling irregularities in the component were observed and studied using the reverse engineering software. The methodology adopted in this research is such as scanning, data preparation and Quality Checks of the material were studied [1].

KEYWORDS: Reverse Engineering, Poly works & CAD/CAM.

I. INTRODUCTION

Reverse Engineering is the process by which designing, manufacturing, constructing and maintaining of products, systems and structures. At a higher level, there are two types of engineering: forward and reverse engineering. [2]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, bill-of-material, or without engineering data such as thermal and electrical properties.[6]The process of duplicating an existing component, subassembly, or product, without the aid of drawings, documentation, or computer model is known as reverse engineering. Surface modeling is a technique for representing surface objects suitable for computer processing. Other modeling methods include surface models and wire frame models. [7] Indigenous product development using conventional means involves a relatively long lead time and cost especially for replacing worn out and broken parts.

Currently [8] there are several RE techniques widely used and known but many of them still leave the object unusable to analyse or future use. Nevertheless, other alternative to this problem can be a kind of Three-Dimensional Scanning, which allows for obtaining a Digital or Virtual Model (VM). Getting the scan (VM) of an item makes it possible to redesign it, perform virtual testing, and check its geometry and features, get conceptual physical models, or even perform functional prototypes for actual tests [9-11].

II. MATERIALS AND METHODS

Materials

In this experimental study the type of rod selected was a normal connector which is used as link for closing and opening of the door in automobiles. The method of manufacturing of this rod was simple forging. However these are different profiles which are readily available in market for the supply. The aim of this work was to elucidate the method of scanning the object and modeling of the component using Reverse Engineering.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

Methods of Scanning:

1. Contour Match Scanning 2. Index Match Scanning.

Experimental Procedure

1. Methodology of Contour Match Scanning:

Fig1. Methodology of the Contour Scanning.

The above figure explains that the methodology of contour scanning which is being used in this experimental study. There are several methods that could be used to carry out the experimental procedure, steps or general ideas for digitization and subsequent manufacture of a prototype can be done. The flow diagram of the reverse engineering is as mentioned below:

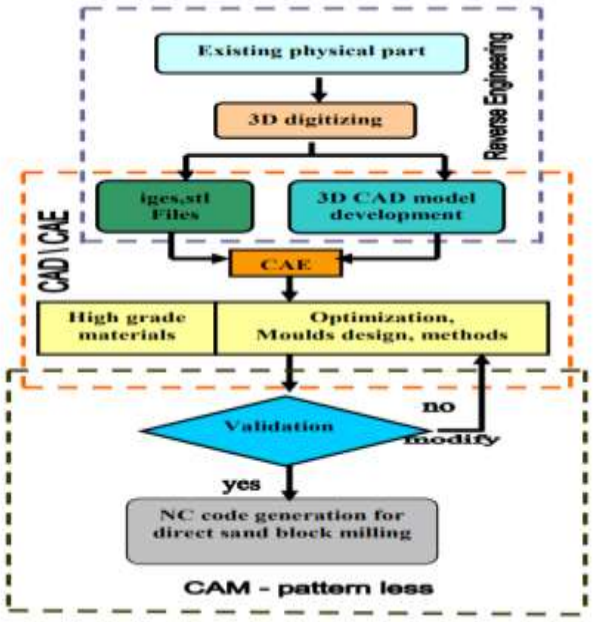

Fig2. Proposed Methodology integrated with CAD/CAM.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

In this experimental procedure the component was scanned with a physical object which has a complex geometry and some other features. Our piece is small and therefore we need to use the lens and the details are as mentioned below:

S.No.	Scanner details	Specified Values
1.	Camera Field of view(diagonal)	250mm
2.	Camera type	Stingray
3.	digitization	1624 x 1234
4.	Camera focal distance	35mm
5.	Software version – OPTOCAT	OPTOCAT2011R2
6.	CAD software – Polyworks	*.ply

Table1. White light Scanner details

The scanner consists of a projection unit which projects the sequence of fringe patterns onto the measuring object. Depending on the measuring object, different adjustable systems and configurations are available, projecting the appropriate sequence of fringe patterns. The system camera(s) capture the projected fringe pattern at a given pre-defined viewing angle. The resulting line pattern varies for each individual object, and even for each individual object and even for each viewing angle of the object.

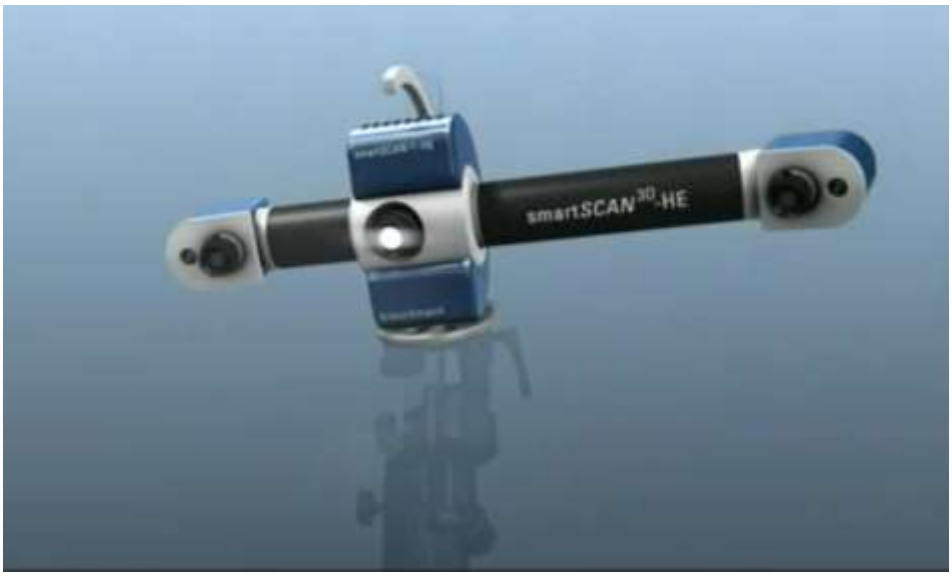

Fig3. Scanner used for experimental study.

Depending on the particular application, systems with one or two color cameras or with black and white cameras with different resolution levels are used. The measurement process is completed once the object has been fully digitized. Within less time the computer calculates the 3D data of the measuring object. The exact image representation of the object is now generated as data set, available for any kind of a further processing (example: CAD/CAM software program).

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

The centre curve was generated using Polyworks CAD software by importing the scanned data and aligning the data into Polyworks software. The Polyworks software is having the capability of generation of CAD model by best fitting methods such as NURBS curves. However the NURBS data can be used in generating the surfaces of smooth objects. However in this case the model is having irregular shapes and curves. However it seems to be difficult to create this data but the data was aligned using 321 alignments and then the model was imported into CAD software.

Fig4. Point cloud data generated by using Scanner.

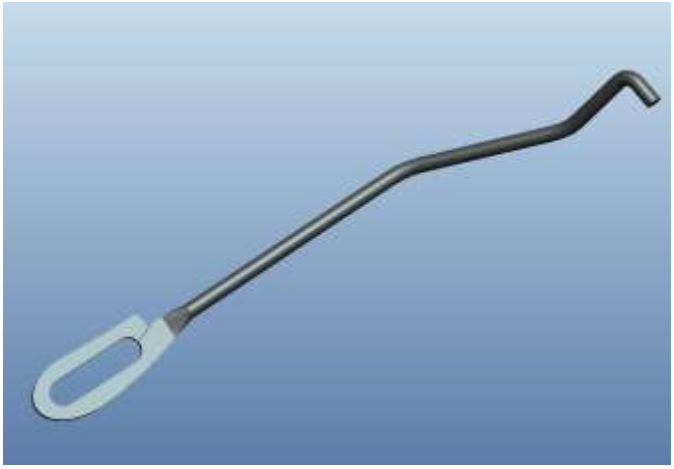

Fig5. Final CAD model of the designed component.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

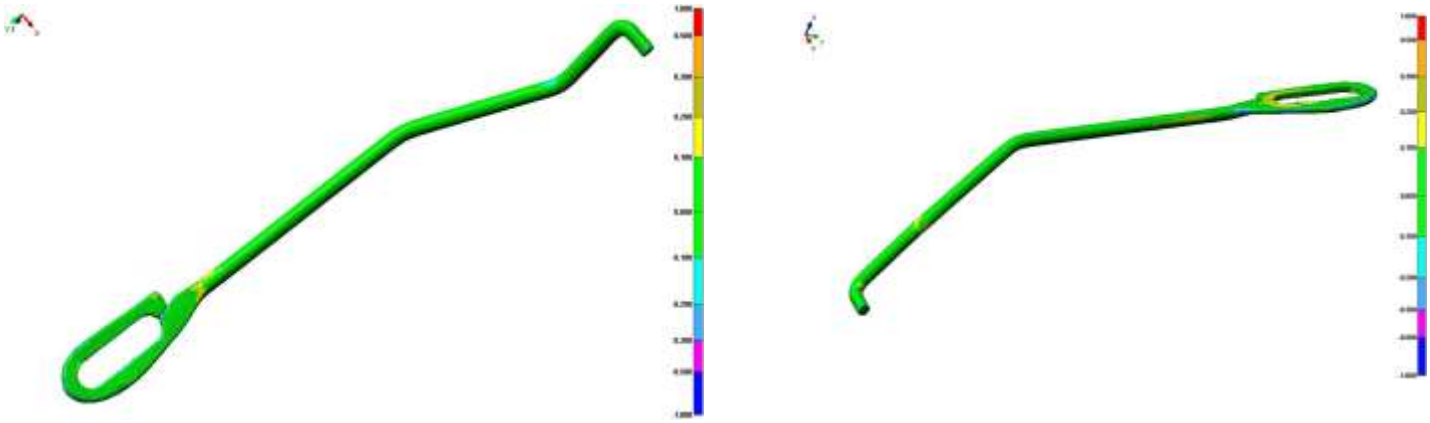

Fig6. Comparison of Geometric model with the Scanned data.

The procedure to convert the point cloud in a solid 3D CAD model. The idea is to draw a solid with the help of the cloud data. This data is just a approximation at the original component, in other words, at the other end the component will be approximation to the same as that of the original component.

III. CONCLUSION

The case study helps us to discover the reverse engineering can be useful for manufacturing of already existing component. In this paper it was explained that the OPTOCAT scanner was used to create the scanned data and the Polyworks of Innovmetric Solutions Inc was being used to convert the scanned data. These data were being imported into CAD software ProE. Reverse Engineering is one of the best processes to design and to restore the data to manufacture the components. *Courtesy: Creative Infocom Pvt. Ltd, Noida U.P.*

IV. REFERENCES

1. Rao S. Vadlamudi, Venture Engineering, Research & Development, 1027 E.14 Mile Rd, Troy, MI- 48083.
2. www.npd-solutions.com/reverse-engieering.html
3. Reverse Engineering, CAD\CAM & pattern less process applications in casting-A case study T.SURESH BABU and ROMY.D.THUMBANGA INTERNATIONAL JOURNAL OF MECHANICS Issue 1, Volume 5, 2011 40.
4. Optimum Material Evaluation for Gas Turbine Blade Using Reverse Engineering (RE) and FEA Gopinath chintala and Prasad Gudimetla. https://doi.org/10.1016/j.proeng.2014.12.413
5. Applications of LASER Inspection for Precision Components- A.SatyanarayanaAlok SinghChauhanR.PradyumnaM.A.H.Baig Defence Metallurgical Research Laboratory, Kanchanbagh P.O., Hyderabad, – 500 058, India - https://doi.org/10.1016/j.matpr.2017.01.142
6. M. Murali Krishna, M.S. Shunmugam and N. Siva Prasad, A study on the sealing performance of bolted flange joints with gaskets using finite element analysis, International Journal of Pressure Vessels and Piping Volume 84,Issue 6, June 2007, Pages 349-357, ISSN: 0308-0161.
7. D.k.Pal, Dr. B. Ravi, Computer-Aided Reverse Engineering for Rapid Replacement Parts: A Case Study.
8. A.P.Valegra, M.Batista, R.Bienvenido, S.R.Fernandez-Vidal, C.Wendt, M.Macros-Reverse Engineering based Methodology for Modelling Cutting Tools.
9. R.Stark et al., Product analysis automation for digital MRO based on intelligent 3D data acquisition. CIRP Annals – Manufacturing Technology, (2013) pp123-126.
10. J.Wang et.al., A framework for 3D model reconstruction in reverse engineering, Comp and Ind.Eng.(2012), pp.1189-1200.
11. J.Vagosvsky, I. Buransky, Evaluation of Measuring Capability of the Optical 3D Scanner, Procedia Engineering, 100 (2015) pp1198-1206.