IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 25-28

Application of Computer Aided Design (CAD) Technology in Modeling Block-to-Spring Fixture

Akshaya S. Bansode[1], Rajesh R. Jaware[2]
[1](Research Scholar,Department of Mechanical Engineering,DMCE, Airoli, Navi Mumbai
[2](Associate Professor,Department of Mechanical Engineering, DMCE, Airoli, Navi Mumbai

Abstract: *Computer aided design (CAD) technologies has become an important tool for efficient new product modeling. CAD involves creating computer models defined by geometrical parameters, using AutoCAD and SolidWorks. CAD systems enable designers to view objects under a wide variety of representations and to test these objects by simulating real-world conditions. The main aim of this paper is to study the advantages and disadvantages of Two Dimensional (2D) and Three Dimensional (3D) modeling using AutoCAD and SolidWorks Software respectively. For this the Block-to-Spring fixture (Assembly-fixture) of switchgear manufacturing firm is selected for study.*
Key Words: *CAD, 2D, 3D, AutoCAD, SolidWorks*

I. Introduction

A number of decisions have to be made which directly affect the product's overall and total cost. One of the first decisions that have to be made deals with the initial design. The engineering, design and drafting world has been experiencing a shift from 2D to 3D views. Many inventors and companies still use 2D drawings and are starting to realize 3D modeling because it can save time and money. The computer-based technology has replaced pen and paper. Drawing and editing lines is faster and more efficient. However, these lines and text are not intelligent lines and text. They are still collections of manually created. [5] Computer-aided design (CAD) is the use of computer technology for the design of real and virtual objects. CAD is 2D technology that outputs a collection of lines and text on a page. These lines have no inherent meaning in the computer or on the printed sheet. Of course, CAD has its advantages over pen and paper, but it is still a digital modeling of the act of drafting. This form of drawing shows us how architects, engineers and designers have worked for the last hundred years. Earlier designers drew plans manually. It was inconvenient, because if any items changed, the designer had to modify each of the other drawings that were affected to consider the change. So, here AutoCAD and SolidWorks makes important departure from CAD platforms. [5]

II. Literature Review

Rita Gaidytė [5] have made the comparison between 2D and 3D modeling, many inventors and companies still use 2D drawings and are starting to realize a 3D design because 3D modeling can save time and money. In this work 2D and 3D drawings and modeling are compared. 2D modeling and 3D modeling have advantages and disadvantages. For this, the comparison. Between 2D and 3D models is made using AutoCAD, Autodesk-Revit Architectural and Revit MEP software. CAD (Computer-aided design) and BIM (Building Information Modeling) technologies also compared as it is related with 2D and 3D modeling.

JozefVask et. al. [6] contribution deals with the transformation of engineering drawings in a paper form into a 3D computer representation. A 3D computer model can be further processed in CAD/CAM system, it can be modified, archived, and a technical drawing can be then generated from it as well. The transformation process from paper form to the data one is a complex and difficult one, particularly owing to the different types of drawings, forms of displayed objects and encountered errors and deviations from technical standards. The algorithm for 3D model generating from an orthogonal vector input representing a simplified technical drawing of the rotational part is described in his contribution. The drawing of the part can contain three primary orthogonal views – front, side and top. All views must be placed in one layer where no other drawing elements, such as dimensions, separate sections and cross-sections, hatching, text information etc., occur. The following types of lines are accepted: bold continuous – for visible edges, thin dashed (short dashes) - for hidden edges, thin dot-and-dash - for axis. These elements must be placed in the first layer of the drawing.

Denis Bobylev [7], in his study researched and got knowledge about three different 3D modeling Software and to figure out the best option for a Mechanical Engineering student at Saimaa University of Applied Sciences and also identify the advantages and disadvantages of each program. The work consists of a theoretical part, which includes the key data about the 3D modeling process, applications, use in Mechanical engineering

field and information about the tested programs. The practical part analyses the 3D modeling process of a chosen software and considers the functions and features of these programs.

Rohit Pandey et. al. [1] in their research paper done the construction of a CAD / CAM integrated engineering data management system provided a direct connection between the design and manufacturing processes. The goal of the system CAD / CAM not only automate certain phases of design and manufacturing, but also automate the transition from design to manufacturing.

Hongyi Sun and Yangyangzhao [2], in the research paper have studied various quality tools such as Total Quality Management (TQM), teamwork, Value Analysis (VA) and Quality Function Deployment (QFD) to speed up new product development

Francis E. H. Tay J. Gu [3], have done study on evolutionary product design methodology that facilitated design alternative identification and adoption in the redesign phase according to their functional content.

Ting-kuopeng and AMY J. C. Trappe [4] in their research paper introduced the concept of the CAD-integrated Engineering data management system (EDMS) which can assist users to save cost and time spent in product re-designing and engineering drafting.

III. 2D And 3D Modeling

A) Two Dimensional (2D) Modeling Using AutoCAD

AutoCAD - a universal Autodesk company created and developed computer-aided design system. AutoCAD purpose is to draw drawings, to simulate the complex flat and dimensional constructions, which are using in construction, Machine, furniture design and etc.[5] The drawing of the part can contain three primary orthogonal views – front, side and top [6]. Fig.1 is Locator's 2D view in AutoCAD. Fig.2 is Supporter A's 2D view in AutoCAD, Fig.3 is Clamp's 2D view in AutoCAD, Fig.4 is Actuators 2D view in AutoCAD, Fig.5 is Supporter B's 2D view in AutoCAD.

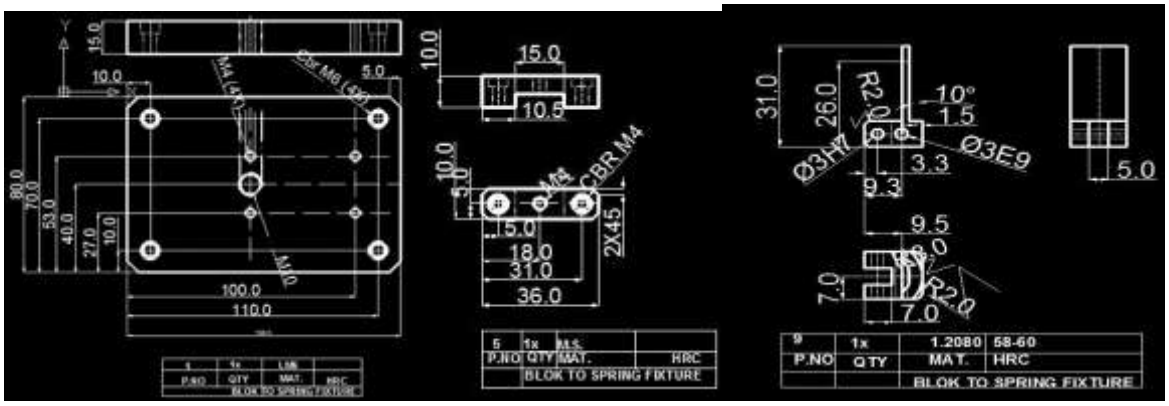

Fig.1 **Fig.2** **Fig.3**

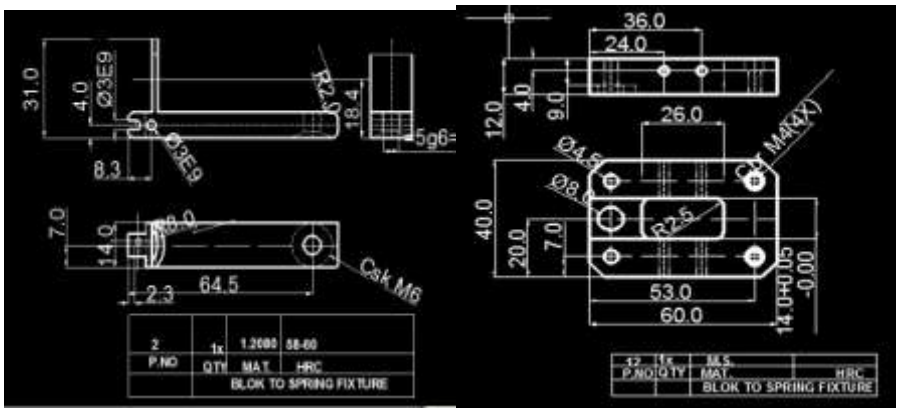

Fig.4 **Fig.5**

B) Three Dimensional (3D) Modeling Using SolidWorks

SolidWorks is a solid modeling computer-aided design and computer-aided Engineering Computer program that runs on Microsoft Windows. SolidWorks company was established by Jon Hirschtick in December

1993. The first version of SolidWorks software was released in November 1995. Since that time 24 versions of Software were published and today SolidWorks takes the leading position on the market of engineering 3D modelling software. Technology, SolidWorks uses the principle of parametric modelling in its technology. The idea of this technology is to express the features of body which consists of complex shapes and geometry with the help of entities, the form of which is set using parameters and relations between these parameters. The parameters are: coordinates of points, lengths of edges, angles, diameters of circles, radius of ellipses etc. [7]. Fig.6 is Locator's Three Dimensional (3D) view in SolidWorks, Fig.7 is Supporter A 's Three Dimensional (3D) view in SolidWorks, Fig.8 is Clamp's Three Dimensional (3D) view in SolidWorks, Fig.9 is Supporter B 's Three Dimensional (3D) view in SolidWorks, Fig.10 is Actuator's Three Dimensional (3D) view in SolidWorks, Fig.11 is Block-to-Spring fixture in static condition, Fig.12 is Block-to-Spring fixture in dynamic condition.

Features

i. Parts and assembling of components: The main feature of SolidWorks is creation of parts. The parts can be different, with simple or complex shapes. When all the parts have been done and saved it is easy to use the feature of assembling which allows to connect all the parts into one system in the needed way and order. [7]
ii. Drawings: After creating a part or assembly it is possible to do the technical drawing for all the components of assembly or the drawing for assembly itself. It is necessary to make sure that the object parts fit properly and operate in the needed way during assembling, that is why the drawings for each part and the whole assembly have to be done. Technical drawings include the dimensions of object, bill of materials, quantity of parts, index number of part and other needed information. Also it includes the views of object from different angles that makes the detail better for understanding and helps customers and manufacturers to understand the shapes and features of object. [7]
iii. Simulation & Analysis: SolidWorks allows users to do the simulation and analysis for the object which was created in this program. The engineering design of the structure can be checked in the conditions set by users, the program creates virtual environment depending on the settings and tests the objects. It is possible to check the behavior of object under static or dynamic loads, check the stability under these loads, also tests for fatigue, thermal expansions and other stresses are available. [7]
iv. Animation & Rendering in 3D: The possibility to animate the part or assembly is a good advantage of SolidWorks. This feature creates an animation which can be saved as a video file. This opportunity gives many advantages during the product development stage and it helps to understand the functionality of the object better. The use of animation helps to save the time, increase productivity and develops the marketing of the product. Engineers can easily communicate with the customers who are far from the 3D modeling field by showing high quality and realistic animations with the product. [7]

Fig.6

Fig.7

Fig.8

Fig.9

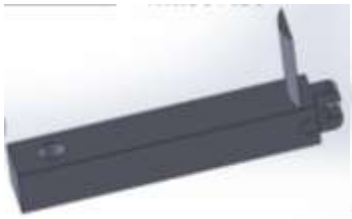

Fig.10

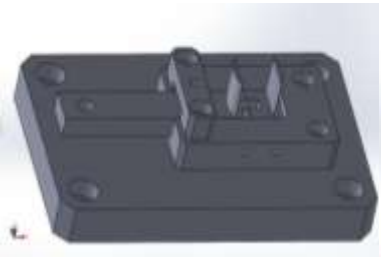

Fig.11

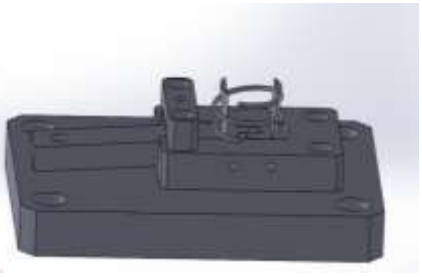

Fig.12

IV. Conclusion

The aim of this paper was to find out the advantages and disadvantages of these two presented technologies. To understand which modeling is the best, a 2D model by AutoCAD and 3D model by SolidWorks software were studied.

- To understand 2D model it is important to know how Fixture Components are drawn and what the symbols mean. In 2D drafting it is not possible to see functionality of object. To draw 2D model is very quick. 2D file could not browse in analysis software
- In 3D modelling it is possible to see each detail of hidden parts, thickness, threading or other details. From 3D design, it become easy to understand because, one can see and know what are Fixture Components in detail.3D modeling gives ability to show a variety of design options to the team and client. If a client can see a 3D Fixture Animation model, one can Imagine how fixture will look after actual manufacturing and functionality of components better. 3D modeling needs more time for design than 2D modeling, because there more information is to be reduced.
- The main difference between 3D modeling and 2D drafting is that, in 3D modeling Components are modeled and in 2D drawing components are drawn. 3D model can browse in analysis software hence application of 3D CAD model is useful in further analysis of Fixture Components.

References

Journal Papers:

[1]. Rohit Pandey, Arvind Singh Tomar& Nishant Sharma, *"A Recent Role of CAD/CAM in Designing, Developing and Manufacturing in Modern Manufacturing Technologies", Vol-2, Issue-3 , 2016 ISSN : 2454-1362*

[2]. Hongyi Sun and Yangyangzhao, *"The empirical relationship between quality management and the speed of new product development", Total quality management vol.21, No.4, April 2010, 351-361*

[3]. Francis E. H. Tay J. Gu, *"A methodology for evolutionary product design", Engineering with computers (2003) 19: 160-173*

[4]. Ting-kuopeng and AMY J. C. Trappey, *"CAD-integrated Engineering- data- management system for spring design", Robotics and computer-integrated manufacturing, vol. 12, No. 3, pp. 271-281.*

Thesis:

[5]. Rita Gaidytė, *"2D and 3D Modeling Comparison"*, Høgskolen I GjøvikVilnius Gediminas Technical University,25.06.10

[6]. JozefVask†, Michal Eliáš, PavolBezák, Zuzana červeňanská1,Ladislav Izakovič2, *"3D model generation from the engineering drawing",* Faculty of Materials Science and Technology in Trnava Slovak University of Technology in Bratislava,2010 Number 29

[7]. Denis Bobylev, *"Comparison of 3d modeling software",* Saimaa University of Applied Sciences Faculty of Technology, Lappeenranta Degree Programmed in Mechanical Engineering and Production Technology, Thesis 2017