Comparative analysis of CAD software packages for engineering design

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Abstract. This work is focused on the comparison of two software packages Solidworks and Inventor. The following two software packages are well known for their ability to design and they share a leading position in the market. A comparison of the functionality of the two software packages will be made. The difference will be outlined on the divorce tools they have. The market share of CAD software packages will also be briefly outlined. Both software packages will then be compared for how easy they are to use for customers. Lastly, the availabilities of the following software will be discussed.

1. Introduction

In the present day, we are granted to use software packages to fulfill the required needs of daily life whether it’s communicational, computational, or others. One can easily say that today’s software packages are more efficient and intelligent. Meaning that they weigh less space and the functionality is way wider. The usage of software in modern times is immense. It is integrated with every aspect of human life. These software packages can be as simple as an alarm clock or complex as combinations of software packages that are used to analyses huge data such as 2D/3D modeling and analyzing tools. Here and hence the usage of the last-mentioned software packages will be covered. These tools are widely used in almost every industry and they can be well adapted for the specifications of the fields. Meaning that they have a diverse range of tools to work with.

These software packages are named as CAD, which means Computer-Aided Design and as well as known in the past Computed Aided Draughting. The CAD usage migrated from aircraft and then permitted into the following fields: automotive, architecture, animation, artificial intelligence, etc. As in any case these software packages are invented to result in lessening time waste (or reduction of the processing time), labor cost reduction (labor reduction), analyze complex problems, that are hard to achieve in real-time. For further increasing the production flow standardized parts files are included in the modern software packages. Today almost every CAD related package have so-called ready files to use as templates or standardised parts files to quicken the process. These standardizers can vary from different types of doors, windows, stairs, and other similar types of objects. However, it was not that
simple in the past time. Companies of manufacturing, architects’ offices, engineering firms had immense premises devoted to labors working on drawings of the products (parts of buildings, bridges, vehicles etc.) [1]. One can argue that some skills were left out with the introduction of software packages and that led to massive labor reduction, which is good for one side and similarly bad for the other side. Nonetheless, it pushed the draughting to a new level.

The following software packages can be divided into two main groups: media and engineering. Where in the first the usage of the software is mainly considered to create the objects and simulate them as to how they would occur in the real world. Hence the objects can have unprecise parameters and no real-life representation. However, in the second group, the preciseness is very essential. Therefore, the correct outcome from the software packages in engineering is the main characteristic when choosing software.

The following group of software packages can be classified into the first group: Blender, 3Ds max, Unity, Cinema 4D, etc. These software packages offer a wide range of tools to work with and are mainly utilized in media and entertainment. Surely, they can be used in other fields such as architecture, mechanical engineering, and similar areas, but due to the specifications, they are commonly used as tools when creating animation, movies, advertisements, or generally in entertainment. Similarly, software packages from the second group can perform some of the functions that can be done by using the first mentioned software packages. However, the limitation will be met when performing some of the functions, thus these software packages are mainly used to build 3D models and if necessary, to analyses them under some different conditions to see how they would perform. Into these packages can go the following software: SOLIDWORKS, Inventor, Onshape, Abaqus, Fusion 360, Ansys, Rhinoceros, Solid Edge and etc.

2. Solidworks and Inventor comparison

The following two software comes from different companies, but both contribute to the same field. The main reasons that these two software packages are popular in the market are the vast number of tools to be used for modeling the given objects, the long-run reputation of the companies, numerical analysis capability, and mostly the user-friendly interface. In addition, these software packages look the same and have almost identical tools. However, there are some major differences and thus the work will look into and outline them.

The following paragraph will be devoted to the comparison of the two software packages. The comparison will be done using two popular software packages Solidworks and Inventor. The main aspect is how good the software is and it can be determined by different features. As was described in this work there are a lot of similar features in these software packages. Therefore, the advantages and disadvantages of both software will be described.

2.1 Functionality

As mentioned before both are similar to each other and both focus on 3D rendering and machine part design. Both come from well-established companies, which have been in the market for quite a while and earned the trust of the users [2]. But by diving, a bit deep one can find out that each of them can provide some unique function the other one does not have.

2.1.1 Solidworks. It can be said that the simulation part of the software can give the necessary requirements for today’s times. It can work on stress tests, temperature, electronics and so on and its giving to user the opportunity to work with a wide range of parameters. Solidworks has a sustainability tool to determine the environmental impact on the built part or parts. Its worth mentioning that Solidwork was the first to recognize the benefits of the usage of AR/VR that pushed the software to the next level. And the most important one of all the large design review. It offers the power to design, test, and model pieces with millions of components without burning out a computer’s CPU. Lastly, due to the fact that Solidworks has been around for a long time, it can offer a large library of tutorials to learn from [3, 4].
2.1.2 **Inventor.** As an alternative to parametric design’s prediction-based process, Inventor offers direct-edit and free-form modeling. The software has its way to automate the math behind scenes for complex moving parts, like kinetic blades or support wires. This allows one to focus on the big picture of a design without getting bogged down by small details. Also, the software has a quick loading time due to its being able to distinguish and load the graphic parts of a design separately from the material and geometric data. Inventor has its own ways to test 3D designs in real-world situations. Its Dynamic Simulation module, in particular, applies specific types of pressure to key points, like torque to joints. A favorite among many is the burst weldment tool. This lets one undo a weld to simulate what would happen if it gave way in an emergency situation [5].

2.2 **Market share**
The main players in the market are Solidworks, and Autodesk’s Fusion 360, Autocad and Inventor. These software packages hold more than half of the overall CAD market share. The survey done by the CNC Cookbook’s on the dates of 2016 and 2017 of the CAD market shares illustrates the four main leaders in the market (figure 1) [6,7]. Over the years the following software packages shifted in the direction of losing or gaining the market share. It is interesting to note that by taking these software packages individually Solidworks around 2015 is still holding first place, but taking Autodesk’s software together it shifts to second place. However, in the following years, the tendency to the leading place takes Fusion 360. If the two of the software packages Solidworks and Inventor to be compared to each other Solidworks stays in the leading place throughout the years.

![CAD Market Share of Top 10 Players](image)

**Figure 1.** CAD market share.

2.3 **User-friendly**
Both of the software is extremely easy to use. Both have a similar interface with the depictive tools to guide the user. Sketching parts of both tools have similar functionality with a bit discrepancy, but these unmatched parts have few influences on the total view. The similarities can be seen in the survey done by the G2 [8, 9]. The survey illustrated that both of the software packages received 8.3 out of 10 marks when the respondents were asked on the terms of easy use (figure 2) [7]. The same thing can be said about the other parameters they are almost indistinguishable.
2.4 Availability

Both software packages are not free and have different prices. However, there are free licenses for the narrowed circle of people. For instance, Inventor gives three years of free licenses for the students, tutors generally for educational purposes. Similarly, the same thing can be said for Solidworks, but instead of free licensing, it provides cost reduction. Nonetheless, the terms can be varied throughout the years. In addition, the availability of the Solidworks for the Apple products is at the moment absent.

3. Conclusion

To conclude, the following work was done on the comparison of the tools for the engineering design. The two software packages were selected on the behalf of their market share and due to similarity of the two. The comparison showed that both are similarly designed and perform almost the same functions. Besides, according to survey of the customers, the similar scores were given for both of the software. However, there are some differences in these tools. The differences come for both software packages from the unique build-in tools they have if compared to the other one. Therefore, one can conclude that the compared tools have for the most time similar functions and methods only differing in the uniqueness.

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