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Solidworks 3D Modeling and Engineering Graphics

Developments in Solidworks over the past twenty years has changed the design and prototyping phase of engineering forever. The creation of the Solidworks 3D modeling program was part of the transformation of methods in engineering. Engineers are now able to go from the ideation phase to prototyping faster than ever before. Solidworks separates itself from other 3D modeling programs on the market because it allows you to create individual parts and combine them using an assembly. Users are also able to quickly create official patent files from their 3D designs, which used to be required to be hand drawn. In addition, Solidworks includes many features not offered by other programs, such as built-in intelligence, improved collaboration, and lower cost of ownership. Before the PC, CAD was restricted to giant closet sized computers which only gave a select few access. Solidworks 3D modeling software increases efficiency for engineers through tactics such as assemblies, 3D printing, and engineering drawing tools.

3D modeling has changed the way engineers perfect ideas and designs before creating a prototype. The design process consists of four phases which include ideation, refinement, design review, and implementation. In the ideation phase, a problem is identified and preliminary ideas and designs are created. Then in the refinement phase which is also known as the iterative process, includes modeling and design analysis. This phase is not meant to show the behavior of the product but to simply show others the shape of the product. The next phase is design review

in which formal meetings are held where the design team presents their idea and the progress they have made to an administration. The final phase is implementation where the final design is transformed from an idea to a commercial product. In this phase, designers meet to determine the most effective method of a moving a product through the production cycle. 3D modeling has changed the speed in which the ideation and refinement phase occur. In the ideation phase, 3D modeling and printing allows the engineer to easily translate their idea into a working model. Software like Solidworks also allows the user to test the strength of your model by running it through stress analysis tests. 3D printing has also helped speed up the refinement phase by allowing quick prototypes to be made, tested, and presented to a design team. 3D modeling technology has changed the speed at which the engineering process is paced.

Before 3D printing and advanced softwares like Solidworks existed the first program was created on the mainframe computer. The father of computer graphics, Ivan Sutherland created the first modeling program called Sketchpad. This program was the first of its kind because it had a feature called constraining lines. Constraining lines allow you to size your model to exact specifications. Then using an IBM computer DAC-1, which was the first design program that was augmented by a computer. After DAC-1 was created the term CAD (computer aided design) was coined by Douglas Ross. Then in the 1970's solid modeling was created by Cambridge University. The boundary rep or b-rep are essentially wire models created by the designer. This was what could be considered the earliest stage of 3D modeling. In 1981, CATIA was the first 3D modeling system to be built. Then came AutoCad in 1983 which was the first program to be taken to PC and then ProE in 1987 which was the first program to include parameters and features for the models. Finally in 1995 Solidworks was invented which allowed

anyone who had a desktop computer to use the 3D modeling program. Solidworks was the first of its kind. In the future engineers look to use simulation in 3D modeling programs to test the usability of the product without actually printing. Virtual reality is also a feature that modeling companies are looking to incorporate into their programs in the future. VR also allows engineers to view and test their models without actually having to print them.

In Solidworks, models are created by drawing simple shapes on different planes and using the boss extrude or cut extrude tool to make the shape into a three dimensional object. This object can be constrained to exact measurements in any unit. The boss extrude feature allows you to add onto a 3D object on an existing plane which allows the engineer to add different features to the object. The cut extrude feature allows engineers to draw a shape onto the object and then cut through the object with the cut being the shape of what was drawn. Another special feature of Solidworks is the creation of parts and assemblies. Using this feature you can organize your models into separate parts and then put them together using an assembly. In assembly you can put parts together using the mate tool which aligns a surface with another. The parts and assembly feature makes it easier to model a bigger part and also gives an exploded view of the model which separates all parts of the model.

Solidworks modeling program has been a centerpiece in the development of engineering. The transition from the ideation phase to rapid prototyping has become faster than ever before thanks to the unique features of Solidworks. The assembly feature, which allows individual parts to be combined, separates Solidworks from its competitors. Modeling is also made simpler in Solidworks allowing users to quickly model 3D objects out of simple shapes using the boss extrude and cut extrude tools. Solidworks 3D modeling software increases efficiency for

engineers through tactics such as assemblies, accurate view orientation, and official engineering drawing tools.

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Research Paper Rubric:

	Level 1	Level 2	Level 3	Level 4
Focus	There is little or no sense of argument, and the paper wanders as a result. Generalizations and inconsistencies disorient the reader.	Central question(s) and thesis statement are present but fairly obvious. Argumentative focus is not consistently maintained or suffers from generalizations. The purpose and relevance of the discussion are not consistently clear for the audience.	Writer establishes central question(s) about the topic and a clear thesis (although it could be more complex). Writer typically maintains this argumentative focus throughout the paper. The audience gets a sense of purpose and relevance, although the argumentative structure could be better defined.	Writer establishes compelling central question(s) about the topic and a clear, argumentative thesis; this argumentative focus is honed throughout the paper. Writer communicates a clear purpose, making the relevance of the argument distinct for the audience.

Content / Organization	Introduction neither hooks the reader nor establishes appropriate context for the thesis. Body paragraphs are underdeveloped or lacking. Conclusion is missing or does not clearly bring closure to the paper. Transitions are incorrect or missing. Quotations are missing or are dropped into the text. Sentence structure and vocabulary are in need of serious improvement.	A hook is attempted, but ineffective. Context for the thesis is either thin or overdone. Body paragraphs might show some of the writer's original thinking about the topic, but they are underdeveloped or inconsistent. Conclusion basically restates the main argument but does not bring a meaningful sense of closure to the discussion or leave a lasting impression. Transitions are effective sometimes, but in other places they are incorrect or missing. Quotations are mostly dropped into the text or are not integrated smoothly. Sentence structure and vocabulary clearly need more development.	Introduction hooks the reader and establishes context for the thesis, although these elements could work more effectively. Body paragraphs develop the writer's thinking about the topic, but more varied patterns of development would improve the breadth and depth of the discussion. Conclusion makes clear how the central question(s) have been resolved, but could do more to add closure to the discussion and leave a lasting impression. Transitions are used effectively most of the time and most quotations are integrated smoothly into the text. Sentences tend to demonstrate sophistication in a couple of the following areas: variation, flow, creativity, mature vocabulary.	Introduction hooks the reader powerfully and efficiently establishes context for the thesis. Body paragraphs demonstrate breadth and depth of thought about the research topic through varied patterns of development. Conclusion is memorable, leaving the reader with a distinct sense of how the central question(s) have been resolved. Transitions link sentences and paragraphs smoothly and quotations are smoothly integrated into the text. Sentences are consistently sophisticated (varied, smooth, creative, mature vocabulary).
Use of Sources / MLA Citation	Research sources are lacking or off-topic. Writer may string together quotations without taking time to	Research sources are fairly one-dimensional, focusing on a single perspective. Writer's own	Research sources establish a couple of perspectives on the topic, but could be more thorough/varied. Writer does a	Research sources are thorough and varied, establishing different perspectives on the topic.

	paraphrase, comment, or analyze. Works Cited page is missing or shows no attention to MLA format.	words are not consistently balanced with quoted material. Works Cited does not include all required sources and/or it has multiple errors in MLA format.	good job of maintaining a balance of own words and quoted material. Works Cited page includes all required sources and is close to meeting MLA standards, with only a few errors.	Writer balances own words (paraphrasing, commentary, analysis) and quoted material compellingly. Works Cited page includes all required sources and is perfect by MLA standards.
Mechanics	Writing is seriously obscured by spelling, grammar, and punctuation errors.	Writing contains many errors. Errors affect reader's understanding.	Writing contains some errors, but not at the expense of understanding.	Writing is polished, free of spelling, grammar, and punctuation errors.