

Designing A Toy Jet Fighter Model by Computer Aided Design (CAD)

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Abstract: *The aim of this study is to introduce a toy jet fighter by using CAD. In order to do so, initially the literature is reviewed and patents are searched for justifying the originality of the design. After having satisfactory results from this review the author made sketching with pencil. The sketches are turned into 3D designs by using computers. Solidworks is used in the design process. The latest design is depicted in the figures and some implications for future research are presented.*

Index Terms: *Computer Aided Design, Jet Fighter, Toy*

I. INTRODUCTION

With the adoption of newer technologies, enterprises are becoming more active in meeting the needs of the customers. Moreover, Gökçearslan (2017: 135) mentions that the future of production is bound to Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM). Thus, there is need for studies using CAD and CAM more effectively.

The present study aims to introduce a new design and stages of designing. The idea is recalled from the monthly purchases for the author's son for toys. The author thought that learning and teaching how to design objects by using CAD make great contribution to the future of production management. To do so, initially the literature is refined in terms of studies introducing new parts and products. Also some former studies are used in order to justify the present study and support the methodology. After the review of the literature, this study includes the stages of design and technical specifications of the design. Lastly, some implic

II. LITERATURE REVIEW

The literature on 3D design and CAD are rich. However, the present study aims to introduce a new product and the phases of product development. So, the author focused on the studies introducing new products via CAD. Also some studies are covered in theory building, supporting the ideas and methodology. The results are as follows:

Varol et al. (2005: 47) developed a piece by using CAD. They explain the phases of the design. They developed a piece by using Powermill. This study provides useful information for justification of the present study.

Yan and Gu (1996: 307) made a literature review on rapid prototyping technologies and systems. The study includes the technologies being used in rapid prototyping. As the present study utilizes Computer Aided Design (CAD), this study can be used in supporting the methodology.

Renner and Ekart (2003: 709) focused on the genetic algorithms of CAD. This study includes useful information on developing a scientific approach on designing and prototyping. The methodology asserted by this work is adapted into the present study.

Chandrasegaran et al. (2013: 204) issued the evolution of production systems. Just like Renner and Ekart (2003: 709), this study also provides the techniques used in designing production. This study can also be used in justification of the methodology of the present attempt.

Kozaki et al. (2016: 13) developed a software for generation of Lego buildings from photographic images of real objects. This study shows that Lego bricks are going to be used more intensely in the future. The implications mentioned in this study can also be recommended for future research.

González-Lluch et al. (2017: 64) worked on a questionnaire for testing the model quality assurance and testing tools. Simplification, interoperability and reusability are determined as the qualifiers of model quality. These dimensions are going to be assessed with the outcomes of the present study. Dani and Gadh (1997: 855) conducted a study on creation of concept shape designs via VR. The study showed that people are going to be ready for paying for virtual products. The present study asserts a new product and virtual reality is becoming widely promoted. This means that people are going to purchase VR items and this will give a chance to designs with CAD.

Gökçearslan (2017: 135) studied reflections of 3D printers on graphic design. This research imply that the future of production management is bound to CAD and CAM. This finding constitutes a good basis for the present study.

Öngöz et al. (2017: 69) investigated the use of virtual reality in law education. They developed a virtual court. This study is important as it shows the importance of virtuality. The present study will make some implications for future research and this one can be a good instance.

Boz (2015: 20) developed 3D origami cubes from 2D papers. This study is organized to depict a classroom activity. In this study, the author mentions that people are more interested in 3D items. The aim of this study is to introduce a new product in 3D. So, this finding can be useful in explaining the aim of the present attempt.

Duatepe-Paksu (2016: 80) examined quadrilaterals by paper folding. This study is also organized as a classroom activity. The author calls attention to the fact that pupils are more capable as they are provided 3D items. This study can also be used in supporting the aim of the present work. Arandyus and Tomc (2016),

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Focused on rendering 3D graphics as an aid to stylized line drawings in perspective.

The study includes useful information on how to convert sketching lines into a 3D design. These techniques are adopted in the present study. To sum all up, former studies can provide useful information on all phases of the present study. Moreover, this study is hoped to make another contribution to the literature.

III. CONCEPTUALIZING AND SKETCHING

As all other designs, the one that is about to be introduced started with brainstorming. First of all, the author tried ways to visualize the idea. Initially sketches on paper are done and origami models are developed (Boz, 2015: 20; Duatepe-Paksu, 2016: 80). These models are taken photos and these images are processed in CAD programs.

IV. DESIGNING VIA CAD

After making various sketching and conceptualizing the model, a virtual model is constituted by Solidworks. This software enables the user to be able to measure the real lifelike circumstances. The design started with building a block. The block is smart dimensioned and the front plane is chosen. A sketch is created and half of the design is drawn and the other half is mirrored. By this way, the author was able to preserve symmetry.

Then, the right plane is chosen and the cockpit and the tails are drawn. The excessing points are extruded and lastly a third sketch is constituted in the top plane. The tails, body and the other issues are constructed. The tails of the plane were too thick and they were refined with extra planes. Lastly, the jet engines are added with another plane in the backside. The final design had some very sharp edges and these were reduced as it is designed to be a toy. Also the nose of the design as detachable for younger kids.

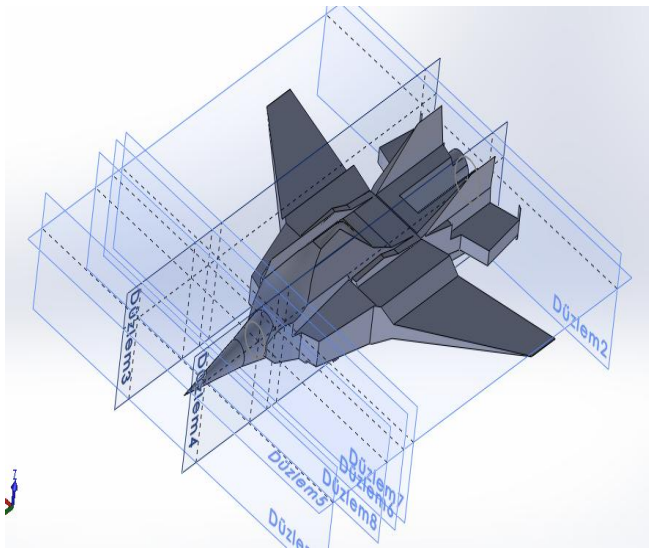


Figure 1. Front Sight (See Appendix for other dimensions and technical drawings)

The former studies mentioned that the design should be evaluated in terms of simplification, interoperability and reusability (González-Lluch et al., 2017: 64). The present design can be accepted as simple as it only have a few stages

to be obtained. Secondly, the present design has interoperability as it can be divided into Lego parts as Kozaki et al. (2016: 13) provides. Lastly, the design is reusable because it can be re-dimensioned and be produced in various sizes. CAD enables the designer to continue further sketching and development.

The mass properties of the final product can also be measured with the software. The mass is found to be 201,42 grams and this is an ideal weight for a toy. The surface area is calculated as 48028.05 millimeters square. All of these measures indicate that the design is big enough (or small enough) to be produced as a toy. Further prototyping may be done with 3D printing and making molds for mass production.

V. CONCLUSION, LIMITATIONS AND IDEAS FOR FUTURE RESEARCH

This study aimed to introduce a toy jet plane design. In order to do so, initially former studies are refined in terms of introduction of a new design, methodology or paradigm. Then, the stages of design are shared and lastly the technical drawings and photos of the design from multiple angles are depicted. Besides these, this attempt had many limitations. The designer had some difficulties in expressing the feelings to the design at the earlier sketching phases. Later on, the ability to use the program developed and this brought self-esteem. The 3D printed parts can also be developed.

CAD and CAM are being presented as the future of production management (Gökçeşlan, 2017: 135). VR technologies are being used in many different concepts and researchers might pay attention to these technologies (Öngöz et al., 2017: 69). The practitioners of CAD and CAM can make use of this design and produce 3D models with additive printers.

APPENDIX

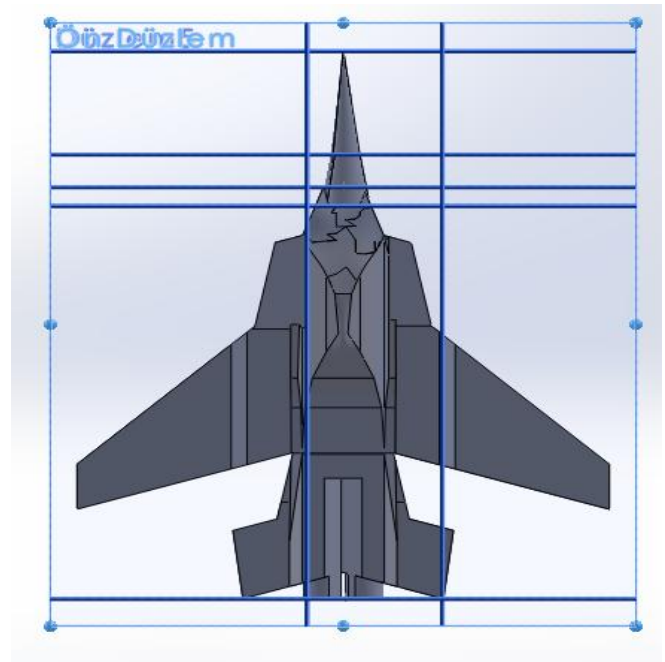


Figure 2. Top plane

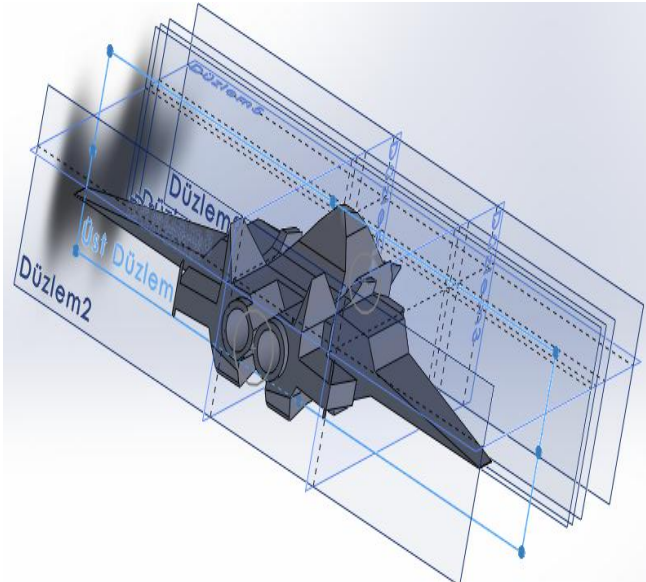


Figure 3. Rear Plane

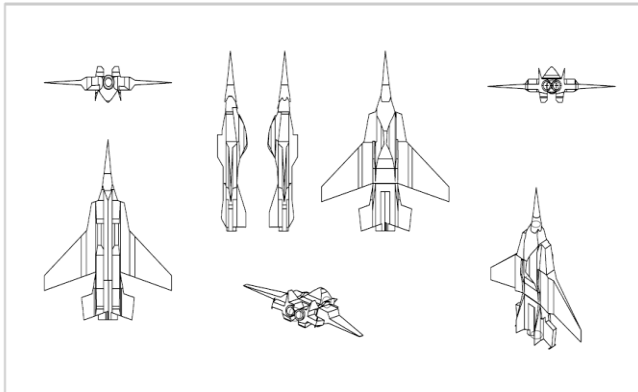


Figure 4. Technical Drawings

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