Computer Graphics and Design Frontloader Solidworks Midterm Brock Taylor

November 29, 2022

This project's objective was to create a computer model of a frontloader toy using the CAD software SolidWorks. The project was started by creating dimensioned sketches of each component of the toy to create a modeling plan along with key assumptions. Each component was modeled separately and placed in an assembly. Dimensions of all parts were measured using calipers with a precision level up to a thousandth of an inch.

1. **Design Intent**

Going into the project, I knew I would have to make some simplifications to complete it within a reasonable timeframe. With this in mind, my main philosophy was to model the part such that it looks as close as possible to the actual frontloader from an outside perspective. Additionally, I wanted to mirror the part structure on the physical frontloader. To accomplish this, I separated and measured each part of the toy, modeling each one independently and constructing an assembly of each part for the final model of the frontloader.

Another main intent in the design of the model was maintaining the functionality of the piece. With this in mind, I paid particularly close attention to the parts of the frontloader that have moving pieces - the front scoop, the front lever, and the wheels. Since the main functions of the frontloader toy are to spin the wheels and to actuate the front scoop using the lever, I made sure that the dimensions surrounding these parts were as accurate as possible.

With a focus on functionality and aesthetics, I also wanted to maintain the feasibility of the project. Toward this, I simplified some of the extraneous details or artifacts of the manufacturing process. For example, some parts of the toy have words that were excluded because they do not contribute to the main design of the part or the functionality.

For each piece, I did keep in mind the complexity of the piece when deciding which details to include or exclude. For example, since the front lever is a relatively simple piece, I chose to include essentially all of the details on the part. I even included the patterned cutouts on the crossbar even though they are covered in the final assembly.

2. **Simplification and Assumptions**

The main simplification taken in this project was to model the inside geometry arbitrarily. I made this simplification for two reasons - 1) The inside geometries will not be visible once the parts are assembled and 2) The inside geometries are generally artifacts of the manufacturing process. This simplification can most easily be seen in the model of the grey base of the toy. Since the top of the grey base is completely covered by the yellow mid-piece, I chose to simplify the inside as a flat plate.

Another simplification that I took was to neglect the tabs that allow the toy pieces to connect to one another. I felt that this focuses more on the manufacturing of the piece and was an extraneous detail for creating a model. With this same philosophy, I chose to simplify the connection between the yellow midpiece and the orange top piece. On the physical toy, the orange top piece embeds itself into the yellow midpiece. However, I chose to have the top piece sit on top rather than embed into it in the model, as the

appearance from the outside is relatively the same.

3. Difficulties Within Modeling Process

The part I had the most difficulty modeling was definitely the top piece. This was primarily due to it not being a solid piece like the midpiece or the base. Instead, it has holes allowing you to see the driver seat of the midpiece. I think that my approach to making the top piece was poor, resulting in greater difficulty. I made the top piece by making a sketch of the right side face, extruding features from it as necessary. However, this resulted in a very complex sketch, making extruded features difficult and tedious. I think that a much better approach would have been to draw the exterior contour on the top face, creating a thin feature extrusion from it to model the walls, and extruding from additional sketches.

The biggest difficulty I experience when modeling was with the assembly. Throughout the project, I modeled each piece independently, taking one piece at a time, measuring, and modeling it in SolidWorks. When I went to assemble the components, I noticed that some of the geometries didn't line up the way I wanted them to, so I had to go back to some of the pieces to tweak the dimensions based on this. If I were to do the project again or work on a similar project, a much better approach would be to make sure when I model a part that it fits with the other parts how I expect it to.

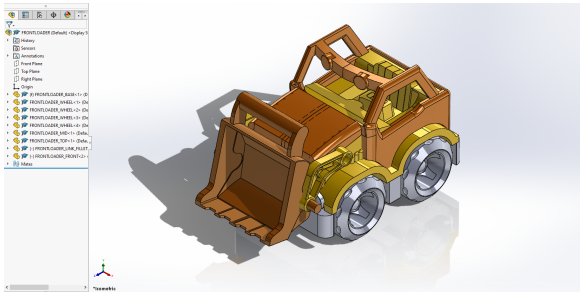

Fig 1. Isometric View of Model

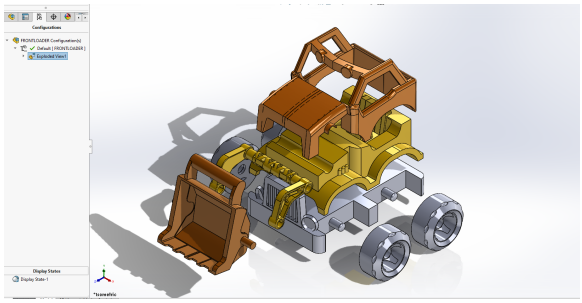

Fig 2. Isometric View of Exploded Model

Fig 3. Top View of Actual Frontloader

Fig 4. Actual Frontloader Components