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1933 Fort Vancouver Way
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98663

2/25/2020

Jesse Kysar
1933 Fort Vancouver Way
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Subject: **Go-Kart Analysis**

Dear Professor Kysar;

This report outlined below is the final deliverable for the assignment assigned by you at the beginning of this quarter.

This report test material properties of the Kart to determine manufacturing. Testing the building material proved sufficient. Simulating aerodynamics showed room for improvement.

I'd like to thank the students and teachers who helped me with this task and for Dassault Systemes for making a powerful tool.

Thank you for taking the time to read this report and please don't hesitate to respond with any questions.

Sincerely,

Matthew Walker

Project Proposal
Go-Kart Analysis
Reklaw

Project Requestor
Jesse Kysar

Purpose & Objectives
This report is the final deliverable for my analysis of my Go-Kart assembly. The project evolved as time constraints proved unmanageable. This is an analysis of a novel Go-Kart Frame. It is made of tube steel and I wanted to test the resilience of the frame on a head-on collision. I also simulated the aerodynamic properties of the Kart with and without a front spoiler

Statement of the Problem or Need:
The problem I am answering is whether or not the material chosen is safe enough in a collision. I am also curious as to whether or not the front spoiler will affect anything at the speeds it will achieve.

Project Description:
I will be modelling and running simulations on a Go-Kart Assembly. While creating a report on the feasibility of the design and any information I learned from simulation

Method & Technologies Used
I used a top-down design method for the Go-Kart. First assembling the frame, then adding in-context relations for the rest of the parts. I decided this was the best way to model because I was making up most of the dimensions and parts myself and this likely won't be built so a 'quick and dirty' model would work best for running the simulations I needed.

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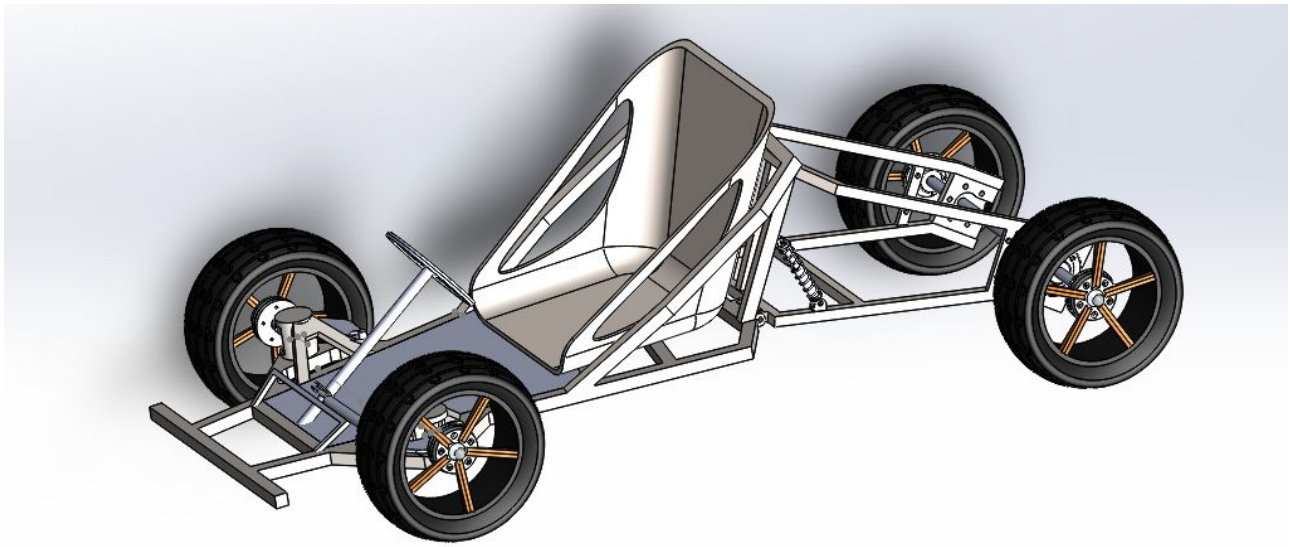
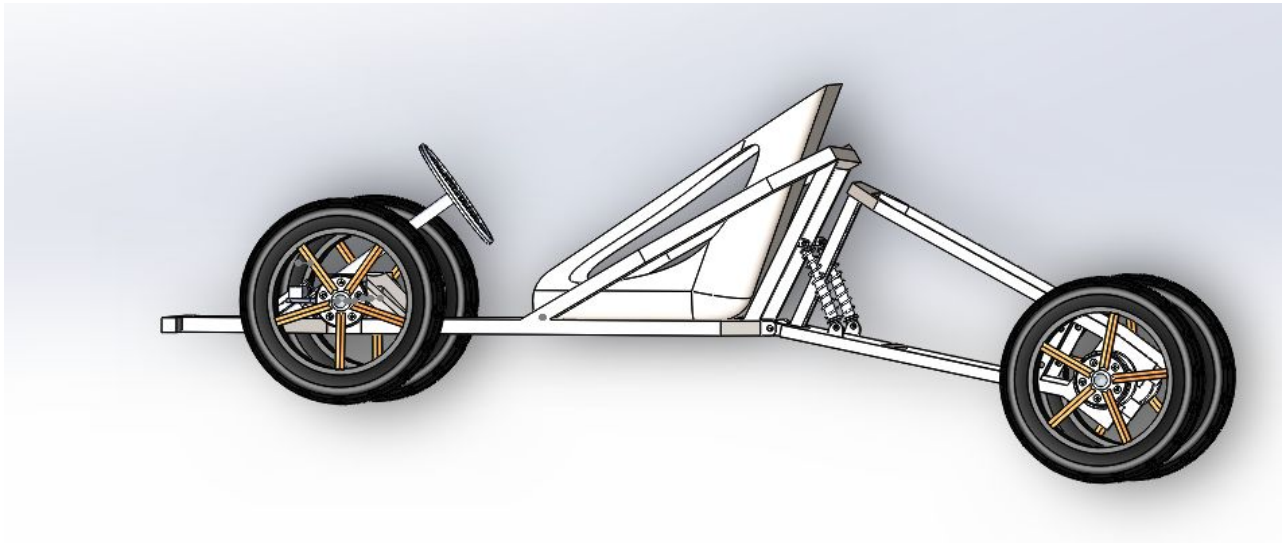
Project Proposal

Go-Kart Analysis

Reklaw





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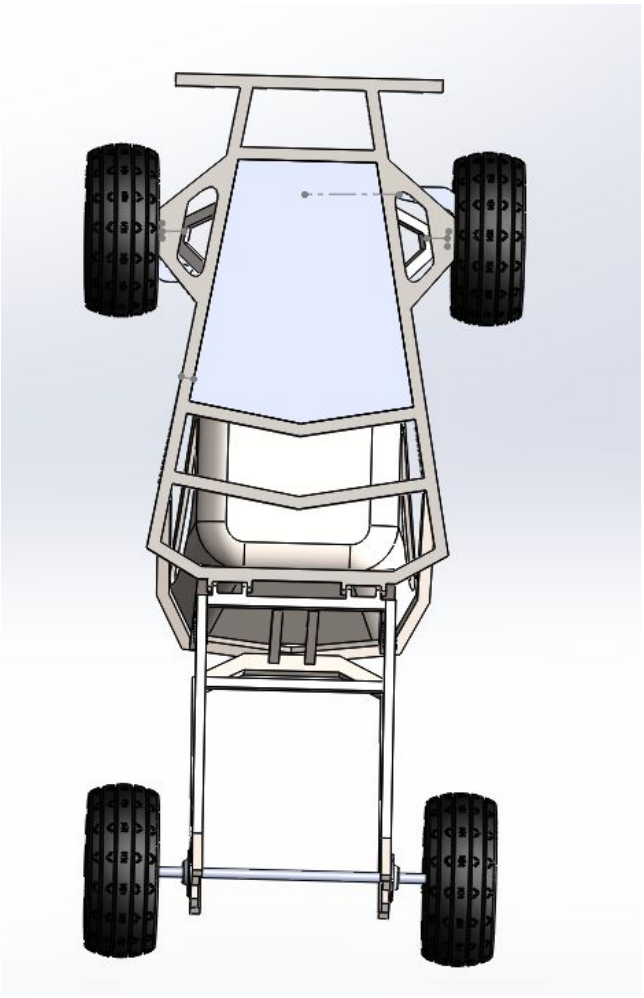
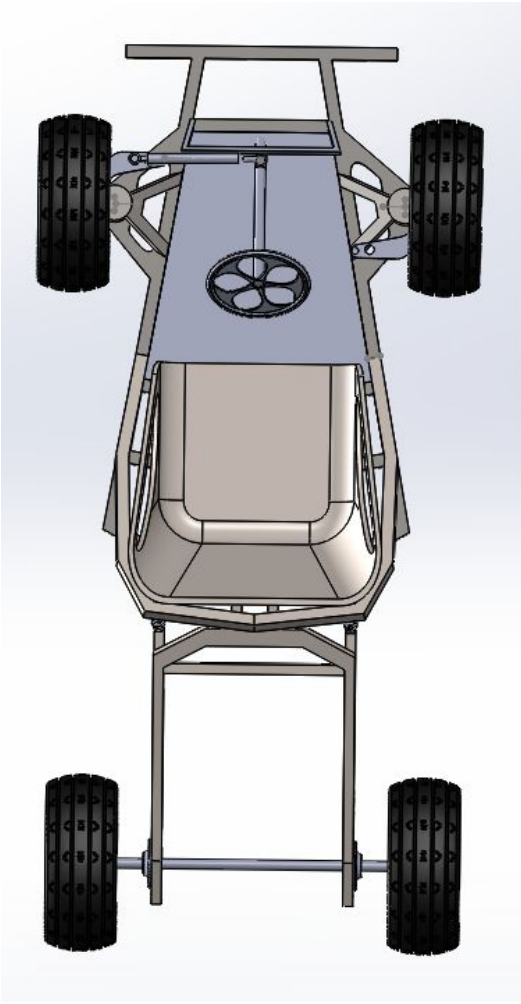
Project Proposal

Go-Kart Analysis

Reklaw





Once my geometry was built I wanted to test whether or not the frame would withstand a head-on collision at 25mph. By isolating the front of the frame and creating load conditions to simulate the weight of the rest of the Go-Kart. I simplified my geometry enough to run my simulation. As you can see from the photos of my results. There would be a very slight deflection and the stresses built up and the connecting bosses look to be well within tolerance.

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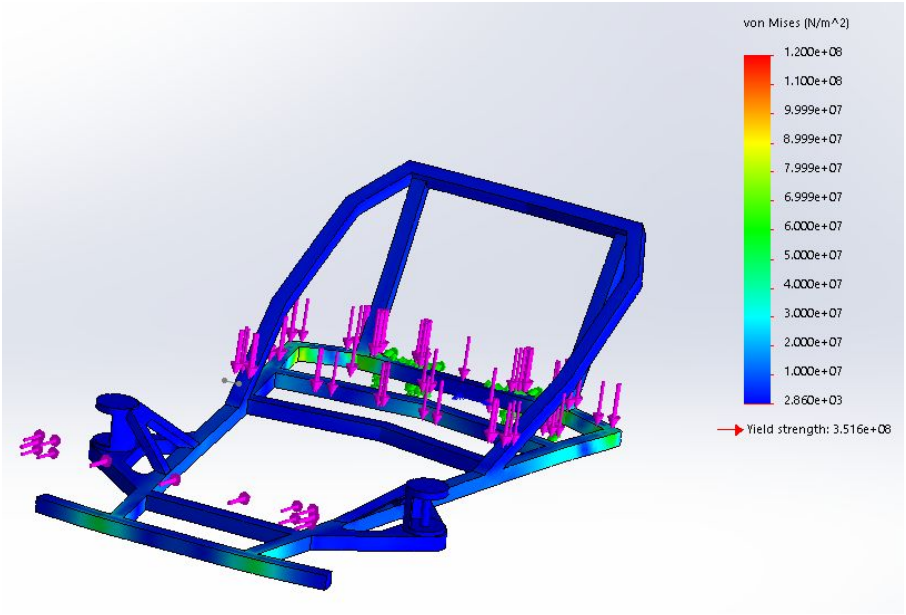
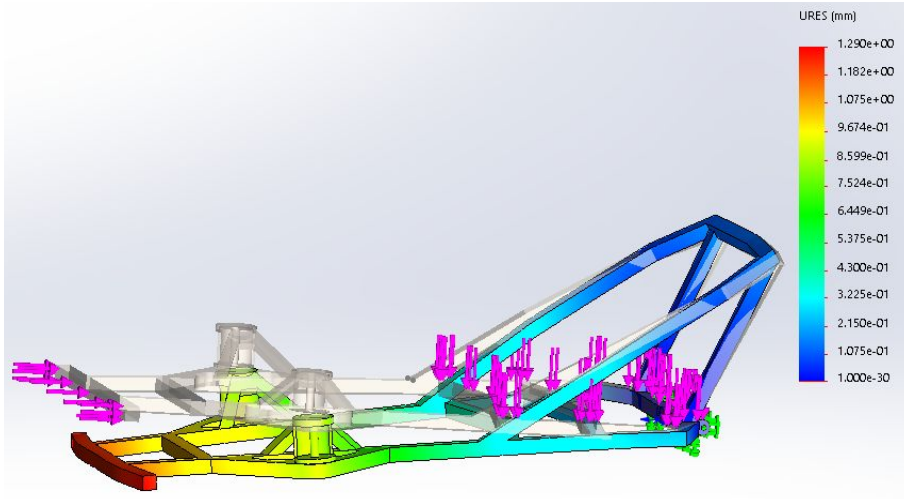
Showing High-Stress Points



Showing Exaggerated Deflection of Frame



In my next analysis, I am looking at the effect of a simple spoiler/airfoil at the front of the Kart. My question is whether or not at the speeds this will achieve that there will be an effect on the turbulent airflow the drive would experience. As you can see in my photos the airfoil does show the effect of moving air from below the frame to above it. It seems to be creating more pressure where the driver sits. At slow speeds, this is unnoticeable at higher speeds the pressure would become uncomfortable. Without

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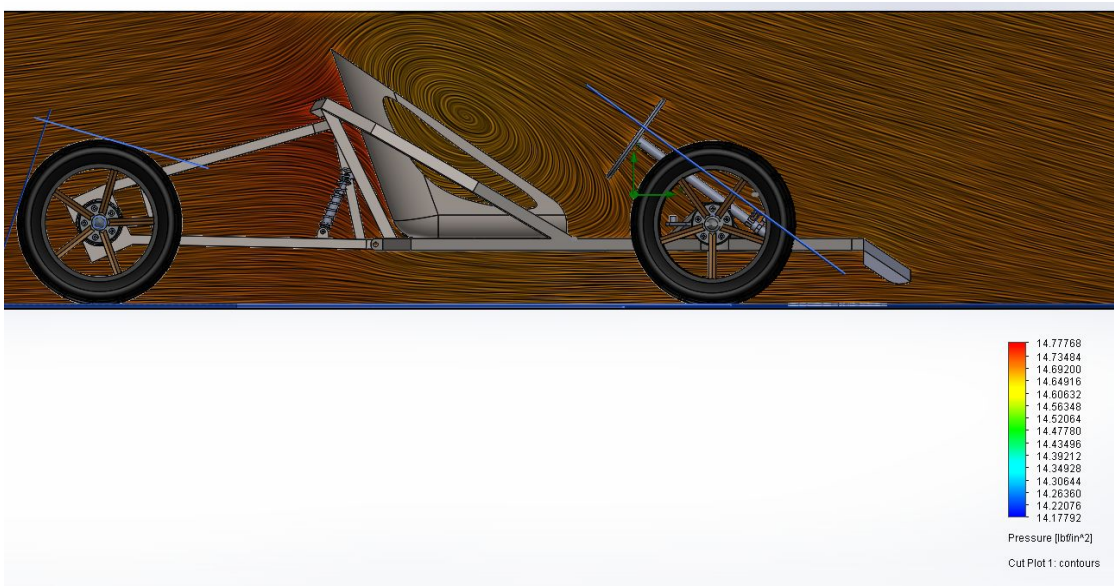
the spoiler, the air pressure does not increase as much as there isn't as much air being moved into that area. For this application, I would suggest no spoiler or look at a redesign.

Without Spoiler - less pressure on driver

With Spoiler - Seeing pressure concentration



Project Risks

The risks I projected in my Proposal, that I would run out of time creating my geometry, came true and I had to modify my study to compensate for that. I am also finding that simulations are not as straightforward as you'd hope and there are a lot of variabilities and it's easy to create nonsense numbers.

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Schedule

By staying focused, using my time wisely, and being honest about my scope. I was able to complete this project on time. Given more time I would have spent more time improving my simulations (i.e. see what happens to rear-end/motor mounts). I also could have studied more body geometry shapes and the effect they had.

Cost

I was able to complete all of my work during class time and while in school so there were no extra costs incurred.

Conclusion

My report concludes that the steel used is more than adequate and that the spoiler designed does nothing to improve aerodynamic properties in this application. I would proceed with the frame design after first testing it in alternate cheaper materials to see if there is a saving to be had. The spoiler needs a complete redesign. The best solution would be a fairing to cover the front of the vehicle.

This was a worthwhile project I got to learn how complex simulations are and at the end of the day Solidworks is a calculator and it will only work as well as you understand it. It was enlightening to see how some geometries were vastly more complicated to mesh than others and the times involved for running the simulations. Having the software at home would have been nice to be able to test more but within the scope of the classroom, there was plenty of time for me to tackle the problem statement.

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