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Carbon Fiber Racing Wheel

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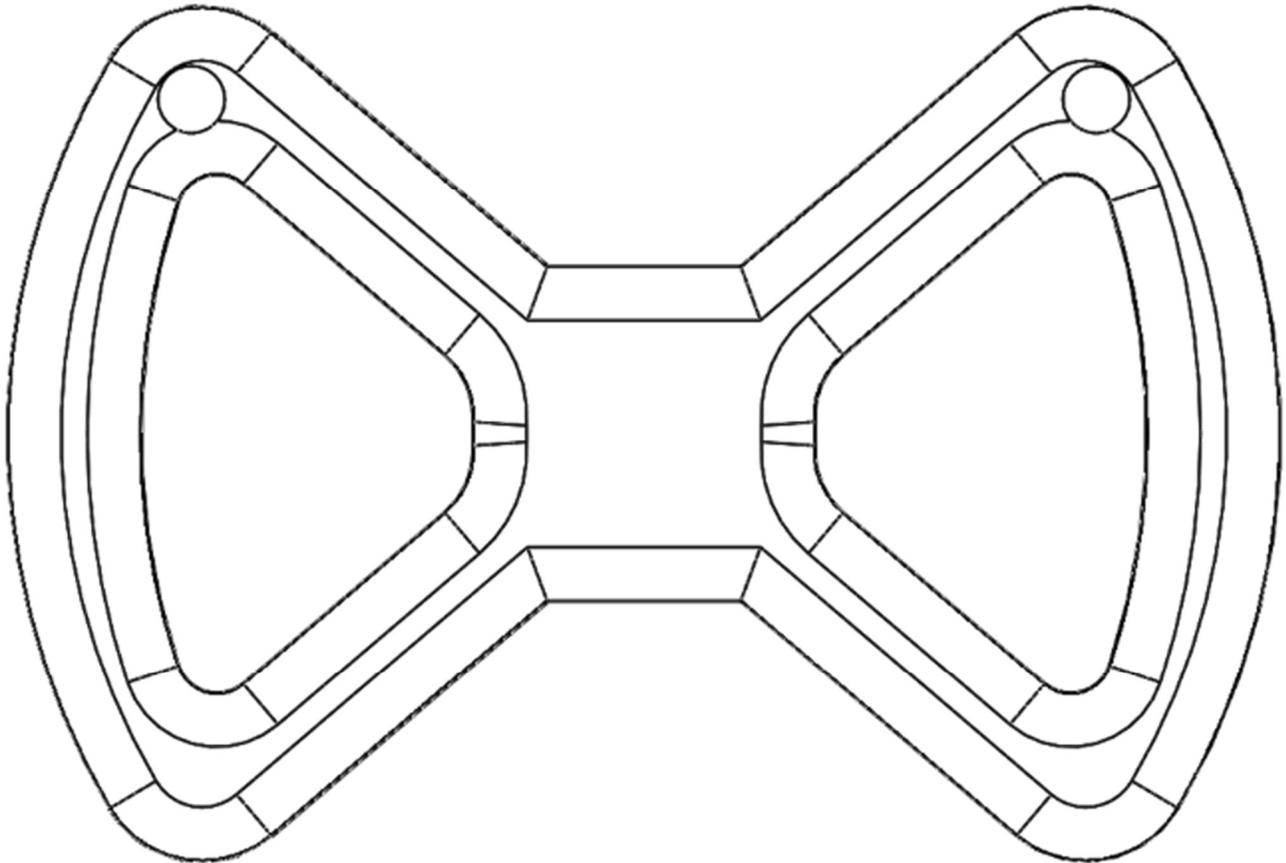
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Executive Summary

The Zips Baja team has been competing for 32 years, representing the University of Akron country-wide. Over this time, the team has made it their mission to constantly look to improve their off-road vehicle and outdo the vehicles it encounters at competition. One of the areas the team has been struggling with is the overall cost of the project. Because there are so many parts and sub-systems, a reduction in material and weight while maintaining strength within the components reduces the amount of money spent on the vehicle. In order to aid the team, our main goal of this project is to minimize the cost of the Zips Baja 2019 steering wheel by reducing the weight.

The process to achieve this goal follows the engineering design cycle. A complete redesign of the steering wheel from brainstorming to installation of the final product allowed our team to have hands on experience over the process from start to finish. The development of our designs began with ensuring that the material is as light as possible while still having enough rigidity to endure the rigors of a race. Once the wheel had been redesigned, it was then transferred into a mold and manufactured. After multiple design iterations, we have come up with a steering wheel that reaches the main goal of reducing weight and minimizing cost.

The initial step to this process was establishing specifications that the team required for the wheel. For example, one element that was required was the wheel had to endure roughly thirty hours of drive time. Our wheel dimensions had to be large enough that it could withstand the forces it would encounter, yet small enough that it would not interfere with the driver's knees while turning. Once we had our specifications, we began brainstorming design options that conformed to the requirements. We came up with eight potential designs and weighed the pros and cons for each before selecting our top three options. For the best three candidates, we ran

multiple FEA analyses to determine the final design. We 3D printed the final wheel design chosen and noticed that the machining and fabrication process would be too difficult, and that driver ergonomics was subpar. This forced us back into the design process where we changed some elements of that wheel design to better satisfy the driver and the manufacturer.

Once the final design was determined, a mold was created in SolidWorks and machined in a CNC 3-axis milling machine. We then laid up the part inside the mold using carbon fiber prepreg that was cured in an autoclave. The cured part was cut, sanded to size, and then drilled through to create holes that connect to the steering column. Next, it was wired for communication. At this point, the steering wheel was sealed and placed on the vehicle and ready to drive. To finish the design process, we conducted a series of tests once the wheel was on the vehicle. Not only could the wheel withstand the forces that the driver put on it, but it also satisfied the ergonomics side of the design cycle.

Once completed, the Zips Baja 2019 steering wheel weight was reduced by 34.5% and cost 41.7% less than the 2018 steering wheel. We were able to meet our goals and expectations for this project as well as help the Baja team in solving some of their cost issues. This project was an exceptional example of real-world problem-solving using engineering tools and gave us an in depth feel for what the design cycle truly entails. The Baja team plans to use our wheel for their upcoming competitions.