**Development, Manufacture, and Testing of a Monolithic Automotive CFRP Wheel**

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A one-piece CFRP (Carbon Fiber Reinforced Polymer) wheel was developed, manufactured, and tested. The wheel was intended to replace Cornell FSAE's existing aluminum alloy rims and wheel centers while providing greater wheel stiffness and decreasing mass. This reduction in mass has a particularly notable impact on vehicle performance and handling because wheels are both unsprung and rotating. Previously, Cornell FSAE unsuccessfully attempted to manufacture two-part carbon fiber rims that interfaced with the existing metallic wheel centers. This year, a monolithic design was pursued. While utilizing a one-piece design greatly increases the manufacturing complexity, it eliminates the issues related to the mechanical joining of multi-part wheels and it has the potential to allow even further reduction of wheel weight.

Isotropic Solidworks Simulation models were created to compare various wheel geometries. Once a geometry was selected, a ANSYS Composite PrepPost model of the wheel was used to iteratively optimize its layup schedule. Coupon and element-scale testing was conducted to verify aspects of the ANSYS model and layup design. The suitability of a variety of specialized manufacturing processes for molding the wheel was evaluated. Ultimately, a novel four-part female mold and multiphase layup process was developed and implemented in order to allow for the complex geometry of the wheel to be fabricated while maintaining adequate dimensional control of critical surfaces. The wheel was manufactured and tested to validate its dimensional accuracy, sealing, stiffness, and ability to endure all anticipated loads. The wheel was found meet all primary design requirements while providing a roughly 20% reduction in wheel weight and allowing for a 1% decrease in overall vehicle mass.