Every year, a team of students in the Master of Engineering program at the University of Melbourne in Australia designs a new vehicle to compete in the FSAE Australasia event. This is a huge task because the student engineers need to learn how to develop a winning design and take it from “paper” to real life in a short time. Upcoming teams have a lot to live up to, as MUR Motorsports placed third in 2013, fourth in 2014 and second in 2015 at the FSAE competition.

A major goal for the 2016 team was to reduce car mass and weight to aid in straight-line acceleration and cornering scenarios. Sub-teams worked on providing lightweight solutions for many of the car components that satisfied design objectives. They accomplished this, in large part, by reducing component size or changing the materials used while ensuring that the component would not fail during the competition — which would be catastrophic. They found ANSYS structural software vital to achieving this goal.

The MUR Motorsports 2016 chassis design involved a major change from previous vehicles: The team used a carbon-fiber monocoque body instead of a steel space frame. This necessitated using ANSYS Composite PrepPost software to model a single shell and simulate the layers of carbon fiber. Once the students uncovered the stresses resulting from a loading condition on the chassis, they stepped through the simulated layers and assessed the stresses local to each layer of carbon. Using specialized composite failure criteria unique to ANSYS Composite PrepPost allowed the team to check for the presence of internal carbon fiber delamination in response to excessive loads. These tools simplified and streamlined the process of composite layup design iteration to reduce mass and ensure appropriate stiffness.

The aerodynamics sub-team used ANSYS CFD simulation to accurately determine how the airflow moved through and over the car. Team members gained insight on how to exploit that airflow for downforce production and drag minimization. ANSYS CFD also helped in optimizing the engine assembly’s intake geometry through iterative design processes.

The FSAE rule set mandates that 100 of the total 1,000 points available are based on vehicle fuel consumption. Engineering simulation made it possible to estimate fuel consumption (by determining the drag coefficient) so that the team could determine trade-offs between fuel efficiency and other areas affecting the competition. Lightweighting, aerodynamics and intake design all contribute to fuel efficiency.

The MUR 2016 team found that engineering simulation was integral to the car’s complex design. Students realized they could not have produced a vehicle nearly as refined without the use of engineering simulation.

Information courtesy James Hancock.

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