Validation of Suspension Loads for Solar Vehicle Design

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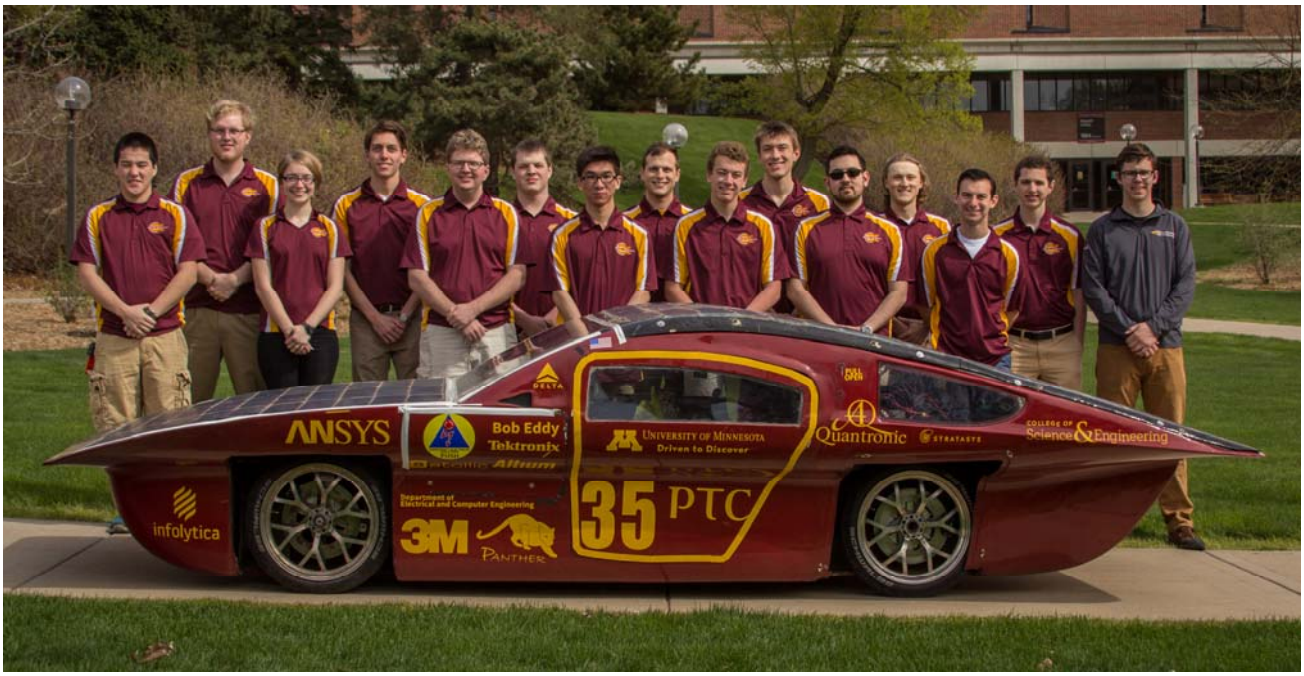


Strain gages from Micro-Measurements, a brand of Vishay Precision Group (VPG), were used by the University of Minnesota Solar Vehicle Project to validate its suspension analysis. This will help determine which parts are currently being over- or under-engineered. As a result, the team can make the car as light and efficient as possible.

Company/Institute: University of Minnesota Solar Vehicle Project

Industry/Application Area: Strain measurement

Product Used:

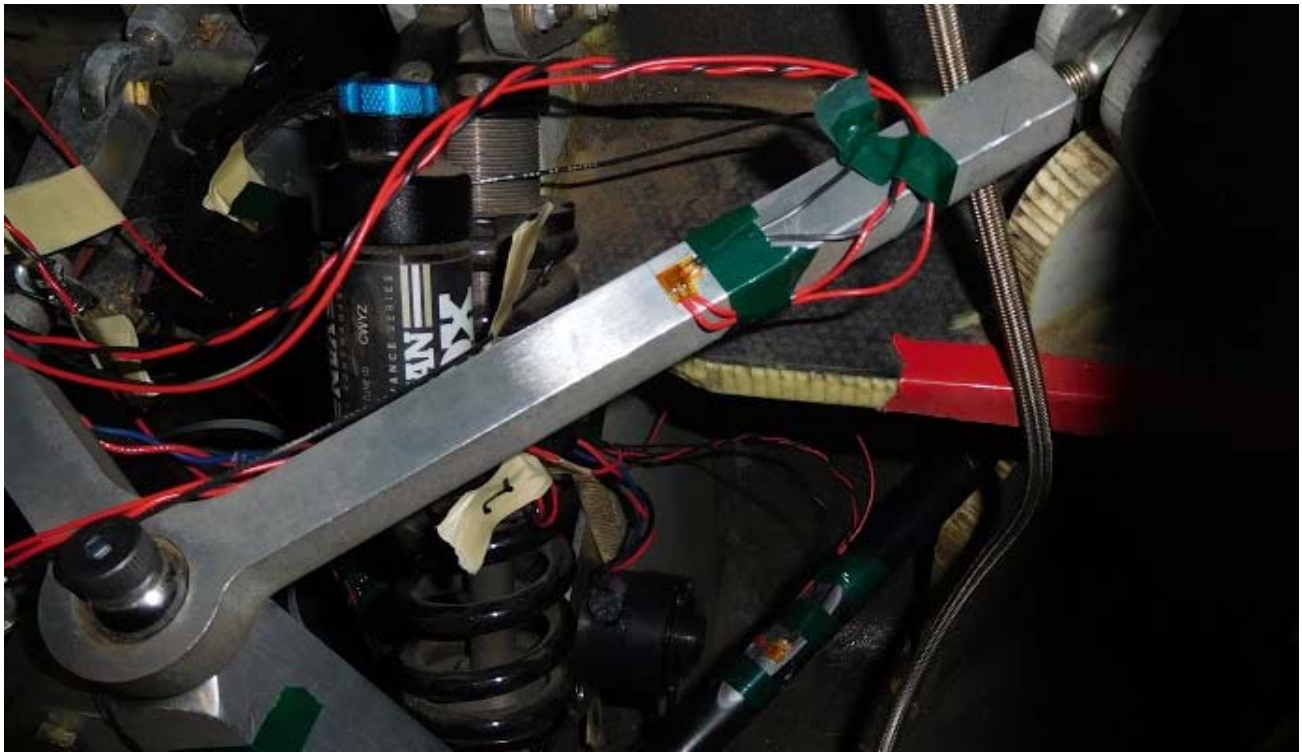
- Tee rosette strain gages
  - CEA-06-062WT-350
  - CEA-13-062WT-350
- M-Bond 200 kit

The Challenge

The standard for analyzing the University of Minnesota solar vehicle's suspension has remained the same throughout the team's history. In that time, little testing has been conducted to actually validate this standard. Therefore, it was decided that strain measurements should be taken on the a-arms of the solar vehicle's suspension to determine if parts are being over- or under- engineered. This will ensure the team is designing with realistic loading conditions and making the car as efficient as possible.

The Solution

The tee rosette strain gages provided by Micro-Measurements were bonded to 7075 aluminum and 4130 steel suspension links using the installation kit provided. To compensate for temperature while measuring axial loads, the team wanted to use a half Wheatstone bridge configuration. The tee rosettes minimized the number of gages needed for this setup, which reduced installation time and potential errors.



An example of how members of the University of Minnesota Solar Vehicle Project bonded the strain gages onto the suspension links

The team used a tensile test machine to generate a calibration curve for each link with known loads. The components were then reinstalled for testing in a nearby parking lot. In each trial, the driver maneuvered over a piece of wood to simulate a bump and then ended with either a hard brake or turn.

The User Explains

Before this year, little testing had been conducted to determine the actual forces exerted on the University of Minnesota's solar vehicle. With the help of Micro-Measurements, the team was able to authenticate its suspension analysis. The results implied that the theoretical loading conditions used are realistic and should continue to be utilized for design. In addition, weight can now be reduced from components with confidence to allow for a more efficient design for future cars.

Acknowledgement

Since its beginning in 1990, the University of Minnesota Solar Vehicle Project has remained a student directed, designed, and built organization. The mission of the project is to teach members about engineering and project management while creating solar-powered cars that continuously improve upon previous designs. The team also takes pride in actively sharing about STEM with the young engineers of the future through a variety of outreach events.

The team is the first American team to compete in the Cruiser Class at the World Solar Challenge. In addition to speed, this class places emphasis on practicality. This poses several new design challenges, allowing the team even more room for innovation.

The University of Minnesota Solar Vehicle Project team would like to thank Donielle Dockery of Micro-Measurements and John Hill from Instrumentation Resources for their immeasurable guidance and support in this project.

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