SUSPENSION LOAD MEASUREMENTS FOR VALIDATION OF REDUCTION OF ROD DIAMETERS

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The case study consists of load measurements of suspension rods. The data obtained was used to validate the reduction of the diameters of some of these rods to decrease the suspension system weight, and therefore, the car weight.

Company/Institute: UNIVERSITY OF SEVILLE (SPAIN)

Industry/Application Area: AUTOMOTIVE, COMPETITION, FORMULA SAE

Products Used:

- CEA-06-062UT-350
- Strain Gage Adhesive (M-Bond 200)

The Challenge

ARUS is a Spanish Formula Student team composed of more than 90 students who designed, manufactured and tested two racing formula-styled cars. ARUS also created two business plans from scratch and made cost and manufacturing studies. Last season we manufactured our 6th combustion car and our 2nd electric car, this was a big challenge for us because we were the only Spanish team that competed in these two categories at the same time.

The objective of the study presented here consists of the measurement of suspension forces on a Formula SAE single-seater. For that purpose, strain gauges were installed on ten suspension rods: two pull rods, two pushrods and six double wishbone rods. Knowing the data obtained in the ART18 (previous car), a study was made in which the diameter of some rods could be reduced by two to four millimeters, depending on the rod. This new design had to be validated, since all the data concerning the new suspension were only theoretical.

The Solution

To measure the forces, strain gauges were bonded as previously mentioned. All the tubes are working on tension-compression uniaxial forces. As only axial efforts were of interest, and the temperature not a conditioning factor, a full bridge configuration was not necessary, so quarter bridge configurations were used.

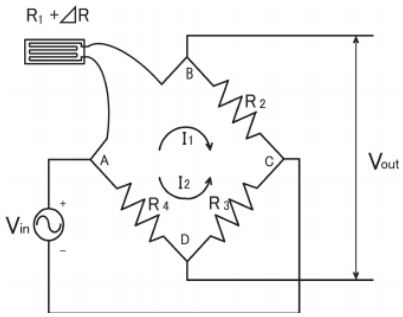

Fig. 1 Gauge bridge configuration used

Fig. 2 Front view of a part the car showing a suspension arm

The proposed strain gauge configuration was complemented with a self-design PCB, which will be explained below. The gauges and the electronic system were tested both on track and in a laboratory located at the University of Seville, more specifically in the School of Engineering. Without the help of that institution, and of course of Micro-Measurements, neither our suspension system nor our car would have been possible.

The User Explains

The voltage increase or decrease was processed by a self-developed PCB, based on a Microchip microprocessor, which simply reads the data provided from every gauge, converts it into a readable unit and sends it to the data logger via CAN Bus. Then, the race engineer was able to read the data and use it for every study needed. It is important to mention that the idea of design PCB was motivated by the necessity of such a high precision in the reading, processing and transmitting system.

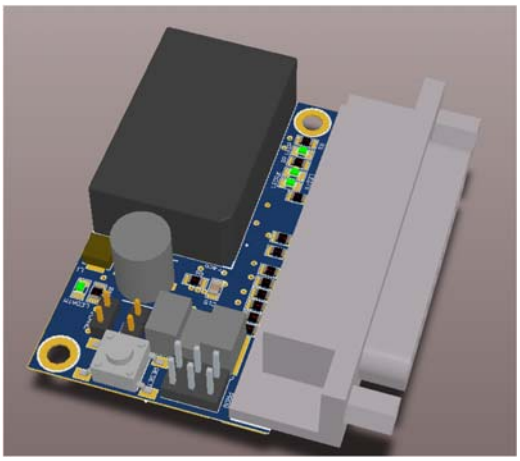

Fig 3. Electronic self-designed PCB

Information was post-processed with dynamic software to monitor measurement data with graphs and numerical values. The results provided a validation of theoretical models and computer simulations. Thanks to the material provided by Micro-Measurements, we achieved the changes designed on paper to a real competition car, being sure that every theoretical change was correctly dimensioned.

Acknowledgement:

ARUS team was founded in 2012 when a group of friends discovered the Formula Student competition. In 2014, with a really low budget, they classified to compete in Formula Student Germany and managed to finish the Endurance, the hardest event in the competition. Since that day, the team has been growing exponentially: from passing scrutineering to climbing the podium in a dynamic event, winning a first place overall and passing the accumulator scrutineering. None of this would have been possible without our passion, and the support of every person behind us.

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