Static and Dynamic Analysis of SAE Baja Car Frames

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EXTENDED ABSTRACT

The Society of Automotive Engineers (SAE) student organization at the University of Kentucky designs and builds a Baja car, an off-road vehicle, every year and enters a nationwide competition. One major task in building a successful Baja car is to design a strong and yet weight efficient frame (roll cage). The finite element analysis (FEA) software, ANSYS, was used to analyze the static and dynamic performance of SAE Baja car frames. The analyses were performed on the previous Baja car frame and the new Baja car frame that was built for this year’s competition. The solid models of the frames were built using design software SDRC-IDEAS. The finite element models were created using beam elements. The finite element models were then brought to ANSYS for static and dynamic analyses.

The Baja car competition consists of static and dynamic events. To simulate the performance of the cars at these events, the frames were analyzed at both static and dynamic loading conditions. The static loads were applied to the frames at various locations to determine the maximum deflections. The modal analyses were performed to extract the natural frequencies of the frames. The results were used to improve the design of the new frame. Using ANSYS, it was very easy to make changes to the frame to determine different ways to improve the design. The final results show that the newly design Baja car frame has less deflections under static loading and higher modal frequencies to withhold the dynamic loading.