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Development and implementation of a topology and size optimized formula SAE chassis

Tyler Jackson & Douglas Smith

The design of the Formula SAE chassis is a critical component in producing a competitive car. An ideal frame is expected to be lightweight and stiff so that a degree of freedom can be removed from the the design of the suspension. Thus, the design of the frame can benefit from the implementation of optimization software in which constraints can be applied to the mass of the frame in order to reach a desired stiffness. The purpose of this project was to develop a process to optimize a Formula SAE chassis which could easily be used by future teams to analyze and develop optimized frames. Topology optimization was used to develop a general idea of how to acheive a stiff, lightweight design. Then a preliminary design was developed using the results of the topology optimization and the requirements of the frame as specified in the Formula SAE competition rules. Finally, size optimization furthered reduced the weight of the frame by optimizing the size of tubes. The completed frame design resulted in a 10 pound reduction of weight and a 20% increase in torsional stiffness.