Cost Effective Light Weight Diesel Front Engine Mount

Overview
The overall goal of this project was to cut the weight of the front engine mount in half by creating a new design and using a different material for the mount. The new design had to meet the same strength constraints the original design because Volvo will use this finished product for the new SuperTruck 2. The challenges of this project included learning new software, finding a manufacturer to possibly create a prototype in one semester, and communicating with companies to obtain estimates for manufacturing the design.

Objectives
- Redesign the front engine mount to reduce the weight by half and maintaining the properties of the previous mount
- Complete design documentation (prints, CAD models, materials...)
- FEA analysis report demonstrating fatigue life of $5 \times 10^6$ cycles
- Part cost analysis demonstrating cost effective weight reduction with a cost ratio guideline of $3.30$ part cost increase per kg reduced on fully industrialized volumes of 10,000 pieces / year

Approach
- Researched different materials with better strength to weight ratios to use for the new design
- Meshed the design using Ansys 18.2 to map the faces in a way the system would recognize
- Ran a Finite Element Analysis (FEA) on the original design to show the stresses the mount endures
- Used the Ansys 18.2 Topological Optimizer to reduce unnecessary material on the original design and equalize the stress throughout given the constraints
- Assured the new design meets the strength requirements and achieved a fatigue life of $5 \times 10^6$ cycles
- Smoothed the optimized design using the Blender software
- Created a foam model as a visual aid to show where the new design cuts material out
- Researched and talked to the manufacturing company Donsco about different techniques of manufacturing the new design, as well as asking about cost of manufacturing
- Created a spreadsheet containing a cost analysis of estimates given from Donsco

Outcomes
- Created a design using Austempered Ductile Iron, which reduced the weight from 20.8kg to 11.865kg
- Assured the fatigue life goal of $5 \times 10^6$ cycles was met along with all other constraints
- Laid out the process for manufacturing the new designed mount
- Formulated a cost analysis to manufacture the part
- Concluded the part would cost $73.45 per part, around $10$ more than originally, but with the allowable cost due to the decreased weight, the cost is under budget around $20