Design of a Bumper

Overview

LORD Corporation already has successful bumpers, but the company wanted a different prospective to come up with both a new design and tool that will help to make the company’s bumpers even more successful in the future. The team’s sponsor presented the problem of finding a new bumper design that meets the load-deflection curve provided in the project description. The sponsor also wanted the team to find or create an optimization tool that can be used as a reference for future bumper projects.

Objectives

The team’s objective was to create a new bumper design that meets the load-deflection curve, verify the bumper through Finite Element Analysis (FEA) testing, and create an optimization tool that will improve any bumper design.

Approach

- The team travelled to LORD Corporation’s facility in Erie, PA to fully understand the project and the final deliverables
- Patents were researched to verify any limitations
- Customer specifications that needed to be met were given to the team, such as:
  - Dimensions of a bracket that the bumper needs to fit inside
  - A space envelope that protrudes outside of the bracket dimensions
  - A load-deflection curve that conveys how the bumper should deflect under certain loads
- Concepts were generated through team brainstorming
- Concepts were selected through a concept scoring matrix based on the project’s top customer needs
  - The team’s top two customer needs were safety and durability
- The team created a 3D model of the top design in SolidWorks
- The team verified the design through FEA testing in Abaqus
- The team created an optimization tool in Excel that allows changes of different parameters in the bumper
  - These parameters were different surface areas, lengths, and modulus of elasticities
- An instruction set was provided to explain how to use the optimization tool
- The team used the optimization tool to refine the SolidWorks design
- The SolidWorks model was 3D printed to represent the final prototype of the bumper

Outcomes

- The load-deflection curve was satisfied through the team’s design under the customer specifications that were provided
- The design was successfully analysed in FEA testing through the software Abaqus
- An optimization tool in Excel was delivered to the sponsor, with an instruction set explaining the step-by-step method to use the tool, to help the company with future bumper designs