Design Optimization of Vertical Drop Lifts in Automotive Assembly Plants – Team 1

Overview
Vertical Drop Lifts (VDLs) are common to modern automotive assembly plants and these machines are prone to failures and break downs. The project was broken into two phases: 1) Research the design, operation, and failure modes of VDLs. 2) Develop methods to monitor VDL failure modes for abnormal vibrations and make design optimization recommendations to prevent failures from occurring.

Objectives
The team’s objective was to limit the time that Vertical Drops Lifts are down for maintenance by determining what common components are most subject to failure. The task was completed by designing a plan for detecting when the components will fail, by using vibrations. The design will include the number of sensors, orientation of sensor axis, and the location of each sensor.

Approach
- Discussed scope, objectives, and sensor technology with sponsor
- Gathered information about operation and composition of VDLs
- Researched the most common points of failure
- Created working CAD models of VDL and individual components
- Developed an understanding of vibration detection and Smart Diagnostics software
- Designed a sketch of where to place each sensor based on component rotation
- Purchased a three axis vibration sensor to conduct tests
- Identified machines with comparable components to simulate operations with VDLs
- Performed tests by changing the sensor’s placement, axis orientation, and stress on the machines
- Graphed and performed fast Fourier transformation to convert from time to frequency spectrum
- Evaluated the results by comparing each axis individually

Outcomes
- Fully functioning concept/test CAD model of a Vertical Drop Lift that specifically replicates the machine’s function in the automotive industry
- An outline for detecting impending VDL failure points (ball bearings, belts, and gearboxes) that slow the automotive production process
- Recommendations on improvement of components found in Vertical Drop Lifts that increase the life of the machine