Project Description

The purpose of an active suspension is to minimize the vertical acceleration force on a mass while it is traveling on a rough surface. In Figure 1, the rotating camshaft supplies the disturbance simulating the rough surface. The linear actuator will actively cancel the disturbances caused by the camshaft. The canceling effect of the linear actuator will minimize the accelerating force on the mass.

A practical application for an active suspension is on a large farming tractor. The suspension could be implemented on the operator seat making the ride over a chiseled field more like riding in grandpa’s Cadillac. If the operator comfort is increased, the productivity level will increase.

The active suspension design includes the following hardware: an actuator, a motor to drive the actuator, a microcontroller, position sensors, a camshaft, and a motor to drive the camshaft. See Figure 1 for the configuration of the active suspension system.

Figure 1 – Active Suspension System
**Input/Output**

The active suspension operates under the direction of a microcontroller. The inputs to the microcontroller are the position sensors, which are placed on the upper platform for the mass and on the lower platform moved by the camshaft. The position sensors are monitored by the microcontroller. Under normal circumstances, active suspensions would not have the lower position sensor for the disturbance input. However, the second sensor will be included to minimize the system complexity.

The outputs of the microcontroller are a PWM and a direction for velocity control of the linear actuator motor. As the camshaft lobe approaches the maximum stroke, the motor needs to contract the actuator. Inversely, the camshaft stroke becomes smaller causing the actuator to extend minimizing the acceleration force on the mass. Figure 2 shows the system block diagram with the inputs and outputs.

**System Block Diagram**

![System Block Diagram](image-url)

**Figure 2 – Active Suspension System Block Diagram**

**Modes of Operation**

For the active suspension testing, the speed of the camshaft will be varied causing the system to compensate at different rates. A second senior project group is designing an active suspension test platform. This system will replace the camshaft disturbances for future groups. The test platform will have multiple input options for disturbances such as sine and triangle waves. The active suspension system must react to the output of the test platform.