Controller Design for a Linearly Actuated Active Suspension System

Functional Requirements List and Performance Specifications

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Introduction

The purpose of the linearly actuated active suspension system to be developed for this senior project is to decrease the vertical displacement of a load supported by an electric linear actuator. This project will use the active suspension hardware constructed and tested for a senior project completed by Blake Boe and Tyson Richards in 2005 [1]. An active suspension system could be implemented under the cab of heavy equipment machinery to decrease the stress and injury rates experienced by operators. The system would also reduce the stress on equipment by reducing the exposure to potentially damaging mechanical shocks. The active suspension design will include a ball screw linear actuator, National Instruments hardware and software, potentiometers, and a motor-driven camshaft.

Block Diagram

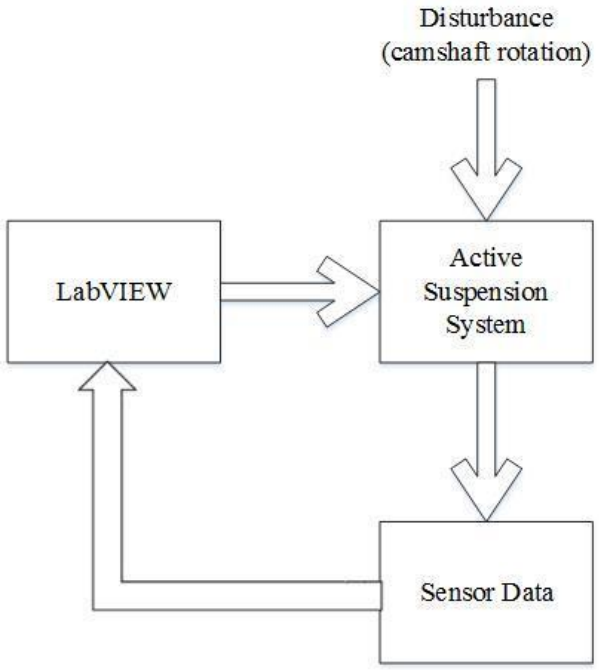

FIGURE 1: Complete system block diagram

A high-level block diagram of the process is shown in figure 1. Disturbances will be introduced to the system by a camshaft attached to an AC motor with a variable speed drive designed to provide external inputs to the suspension system. The controller will be developed using National Instrument's hardware and software (LabView™). Sensors will provide data to the National Instrument's module to provide feedback to the system controller.

Functional Requirements

- The controller shall drive the linear actuator to maintain a midpoint level, yet to be determined, and minimize displacement for a disturbance with a frequency of 5 Hz
- The system shall minimize displacement of the cab from the midpoint to +/- ⅛" (3.175 mm) with no load
- The system shall minimize displacement of the cab from the midpoint to +/- ¼" (6.35 mm) with a 30-lbs load

References

[1] Blake Boe and Tyson Richards. "Active Suspension System", Senior Project, Electrical and Computer Engineering Department, Bradley University, May 2006, http://cegt201.bradley.edu/projects/proj2006/actss/