Active Suspension System Test Platform – Controls

Functional Description

Project Member:

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Project Overview:

The overall purpose of the project is to design and build a reliable test platform to simulate the effects of various inputs expected by active suspension systems during normal operation (e.g., automotive suspensions and operator platforms for agricultural equipment). The platform will be utilized to provide simulated inputs to test future active suspension design projects for the Bradley University ECE department.

The initial focus of this project will be to develop a mathematical model for a given linear actuator and motor assembly. The project will then develop a closed loop feedback model of the platform, actuator, and motor. The closed loop model will be used to adjust a pulse width modulated (PWM) signal to ensure the platform provides the desired input regardless of the load applied to the platform. Matlab and Simulink will be used to design and simulate the required feedback system, and the actual feedback control system will be implemented utilizing an EMAC Micropac 535 micro-controller based development system. Another project team will select the proper linear actuator for the system and provide the power electronics required for the interface with the EMAC Micropac based feedback control system.

System Block Diagram:

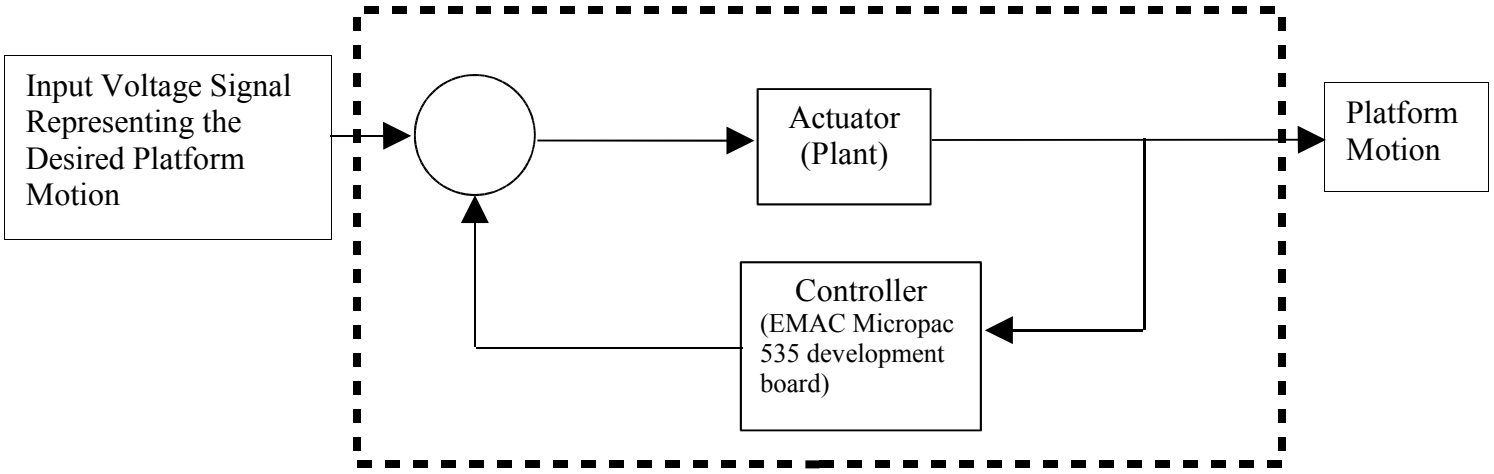

Figure 1 - System Block Diagram

Note: For the system as defined in the figure above, only one global input and output exist. There are, however, numerous other signals present in the system's interior.

Actuator Block Diagram:

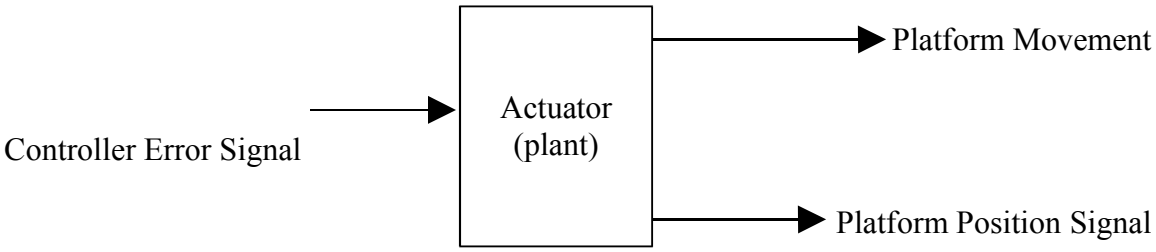

Figure 2 - Actuator Block Diagram

Controller Block Diagram:

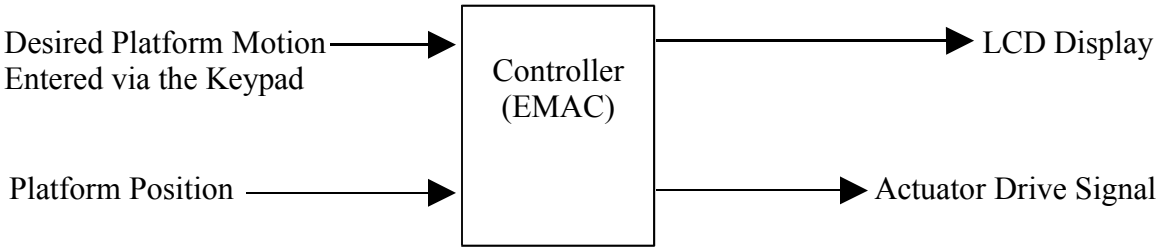

Figure 3 - Controller Block Diagram

System Inputs and Outputs:

The only true input to the system is the desired platform motion as selected from the keypad. The output of the system will be the platforms motion precisely following the desired motion.

System

Inputs	Outputs
Desired Platform Motion (R)	Actual Platform Motion (C)

Note: Desired system response is C=R, or C/R = 1.0

EMAC Micropac 535 micro-controller based development board (Controller)

Inputs	Outputs
Keypad (Desired Platform Motion)	Actuator Drive Signal
Platform Position	LCD Display

Actuator (plant)

Inputs	Outputs
Error Signal from Controller	Platform Movement
	Position Signal

Modes of Operation:

The operator input through the keypad of the EMAC Micropac 535 micro-controller based development board will determine the mode of operation. The operator will be prompted to select a desired platform motion. Possible types of motion will include sinusoidal, step, and triangular. The operator will then be asked to select the desired frequency and amplitude of the platform's motion. These selections will be limited by the software timing and selected hardware. Limitations will be determined once initial research has been conducted and a final hardware configuration has been determined. The system will control the platform position to ensure the system output correctly follows the desired movement regardless of the load placed on the platform.