Introduction

The goal of this project is to design multiple controllers to reject a variety of disturbance classes such as step, ramp and sinusoidal functions that will also stabilize a magnetic suspension system. The controllers, on an xPC Target box, need to be created so that the system has minimal steady-state error, a fast settling time and a limited amount of overshoot.

Block Diagram

Figure 1 shows the overall system block diagram, which includes the three inputs and the external output. Not shown are the internal signals, which are required to control the system. A further expansion of this system can be seen in figure 2.
Figure 2 - Detailed System Block Diagram
Figure 2 shows a more detailed system block diagram. The two inputs and the output are clearly shown, and the internal signals are also shown. The disturbance and the control signal ‘u’ are summed and are then fed into the magnetic suspension system. The controller compensates for this disturbance so that the magnetic suspension system does not actually “see” the disturbance. The two major subsystems, the controller and the plant, can be expanded further.

Figure 3 - Block Diagram of Magnetic Suspension System
Figure 3 represents the block diagram for the magnetic suspension system. The control signal is summed with the disturbance and these drive the coil driver which converts a voltage to a current. This current induces a magnetic field about the coil, which attracts the ball. The ball then prohibits light from being cast into the photo sensor at a specific
level indicative of the location of the ball. This location is converted to the position signal in the form of a voltage.

**Figure 4 - Controller Block Diagram**

In figure 4, the controller aspect of the system has been expanded. Using the ± 10 volt A/D and D/A converters on the xPC box, the error signal and the control signal can be transferred from the target box to the magnetic suspension system and vice versa.

Once the controller algorithm is determined and the controller is being designed, a flowchart outlining said algorithm will be created. Any additional block diagrams that need to be created to further explain the controller will also be created and added to a final report.