**Executive Summary**

Five different techniques were used to design controllers for a plant with uncertainty. The uncertainty variable α, ranges from 0 to 1, with 0.5 being the nominal system. Most results were fairly similar but ease of design varied considerably. The important factors of each technique will be summarized.

**Root Locus**

The performance of this controller was average compared to the rest. This controller also took the most amount of time by far. Slight modifications to the gain or the zero location caused large changes in the specification parameters which made it difficult to tune. The resulting controller was a PI type and met all specifications but better methods exist to design a controller.

**pidTuner**

The pidTuner function provides a nice GUI that can be used to help optimize the system. Sliders at the top of the GUI allow the PID type controller parameters to be varied. Almost all of the specifications could be viewed in the GUI window and updated as the slider postion moved. This made optimization fast and easy and provided a controller that performed better overall versus the root locus method controller

**pidsearch**

The controller found using pidTuner was used with the pidsearch function. The function helped to further fine tune the pidTuner output. Optimizing based on the nominal system was deemed best and focusing on minimizing overshoot provided the best result. It was better in all respects compared to the pidTuner controller except for settling time.

**Unity LAM**

While this technique is initially hard to understand, when used correctly it provides a tailored controller based on the plant. Because the lamdesign function required six poles for the plant, the three valid poles found using the LAM technique were doubled causing two poles to be present at each of the three locations. The resulting controller was much more complicated but the results were the best out of all the ones tested.

**Two Parameter LAM**

For the two parameter LAM controller, the lamdesign function was used. For this case the function required the final closed loop transfer function T(s). This means that this technique is used to generate the two parameters for the controller that will form the desired T(s). The transfer function of the unity LAM was tried but did not work. The transfer function from pidsearch did work however and the two parameters for the controller were found.