Movement in the Z direction would involve forces that could also affect the roll and pitch, so this system has multiple outputs. A decision was made to use 4 motors in order to control these axes, so the system has multiple inputs. Therefore, the system must be described as multiple-input multiple-output (MIMO). This caused some interesting obstacles in terms of modeling and simulating because the plan was to use Matlab which doesn’t handle MIMO systems very well. The equations below were used to describe the outputs:

With the assumption that the Underwater Autonomous Vehicle (UAV) would not be performing any kind of banking so that and are close to zero. As long as this is the case, the system can be viewed as 3 separate single-input single-output systems. With this set-up, it is easier to simulate the system and create a proper controller. However, it does create some limitations to what can be controlled. If the UAV were to be tipped too far, the controller would likely not be able to compensate for the angle. Since the UAV will not be encountering any unknown obstacles, it was decided that this solution would be good enough for its application.