AE450 Assignment 2

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1 Problem 1

In this problem, we expect the drone to hover as the control input is just enough to make the drone hover. So, we expect no change in position.

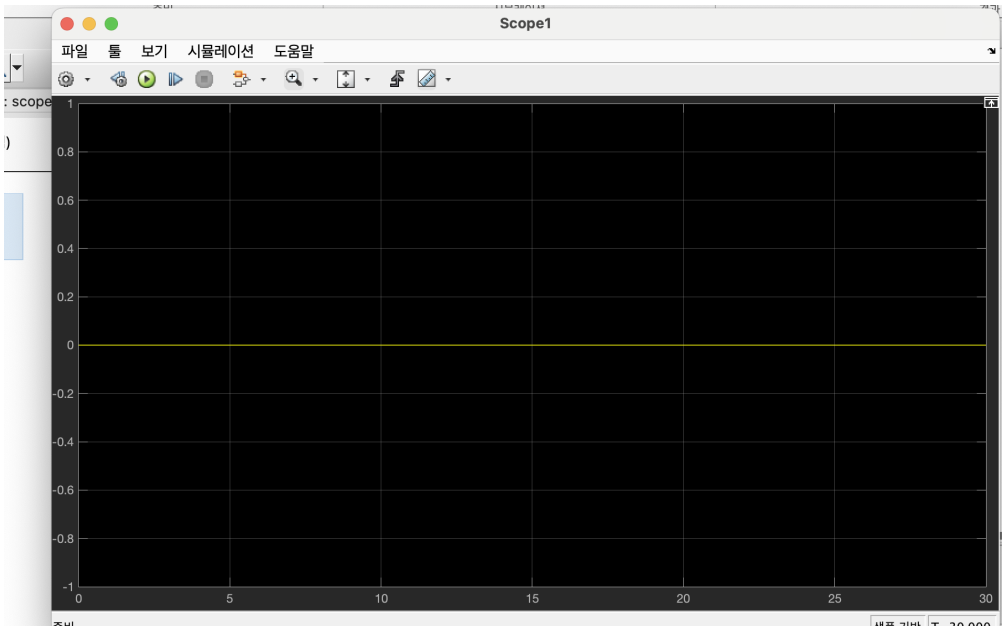

Figure 1: x position vs time

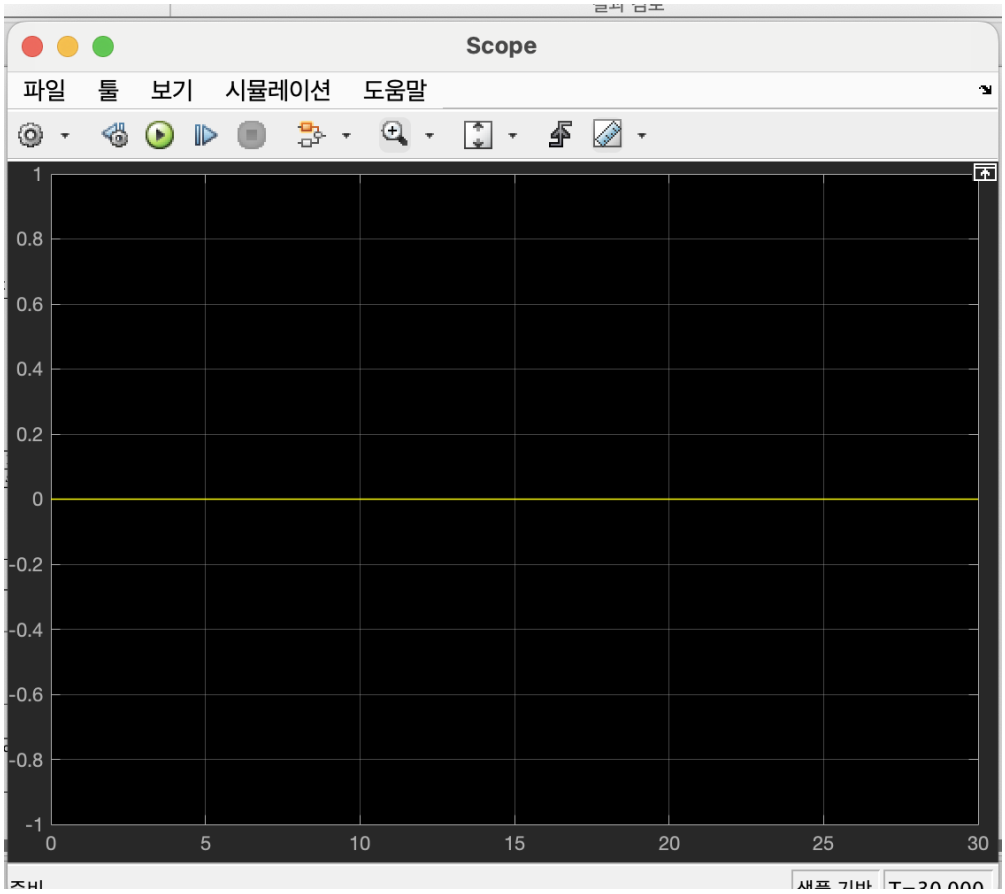

Figure 2: y position vs time

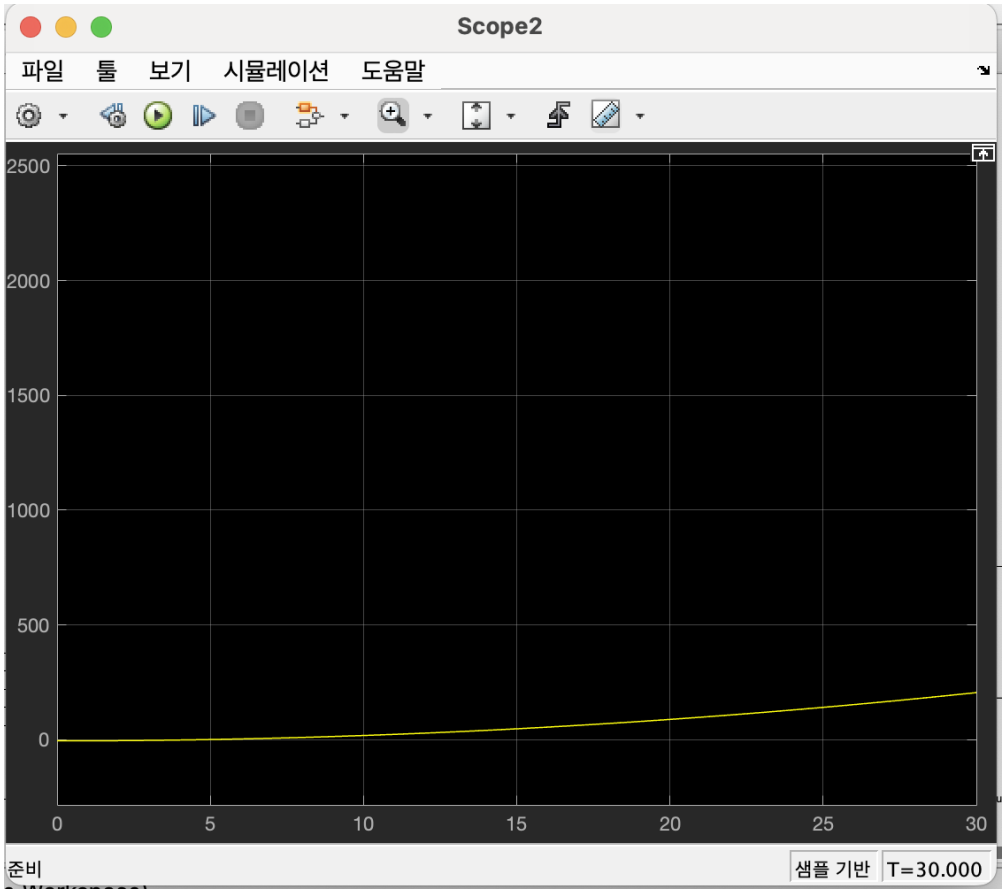

Figure 3: z position vs time

We can see that the z value keeps increasing parabolically. As the z axis points downwards, this means the drone is falling down.

Contrary to what we expected, the drone could not hover in the air. The reason for this is that we are using a P controller for actuator model. In proportional controller, at some value of T_i, $T_c - T_i = \tau * T_i$ will hold. When this happens, T_i will be $\frac{T_c}{1+\tau}$ which is lower than T_c - actual command required to make the drone hover.

2 Problem 2

As the momentum is given only in x direction, this means that the drone will spin in YZ plane.

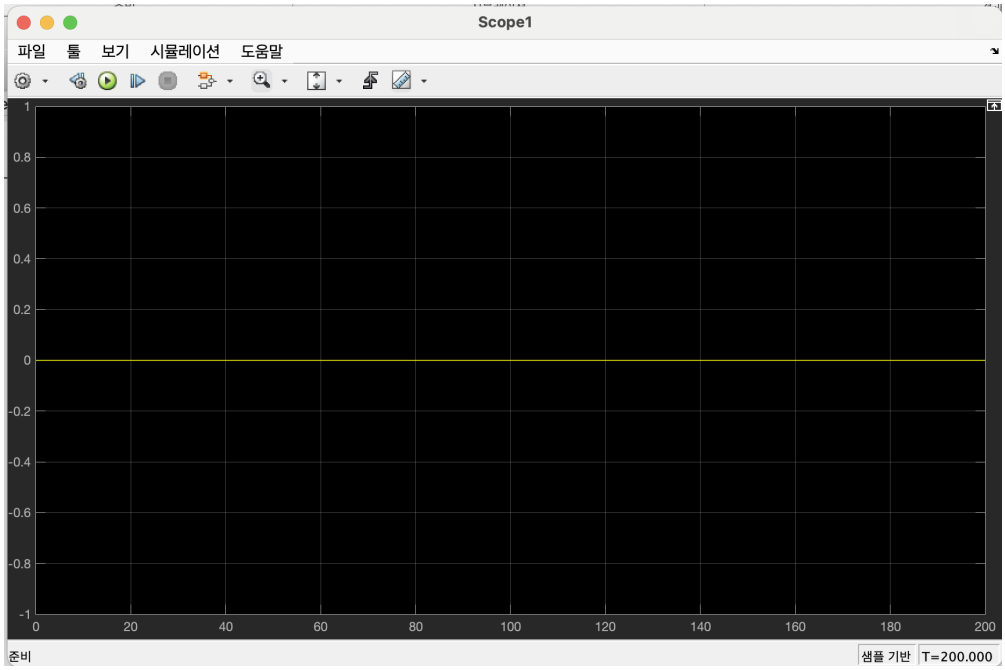

Figure 4: x position vs time with x axis momentum

There is no x axis position change as the drone is just spinning in the YZ plane and trying not to fall.

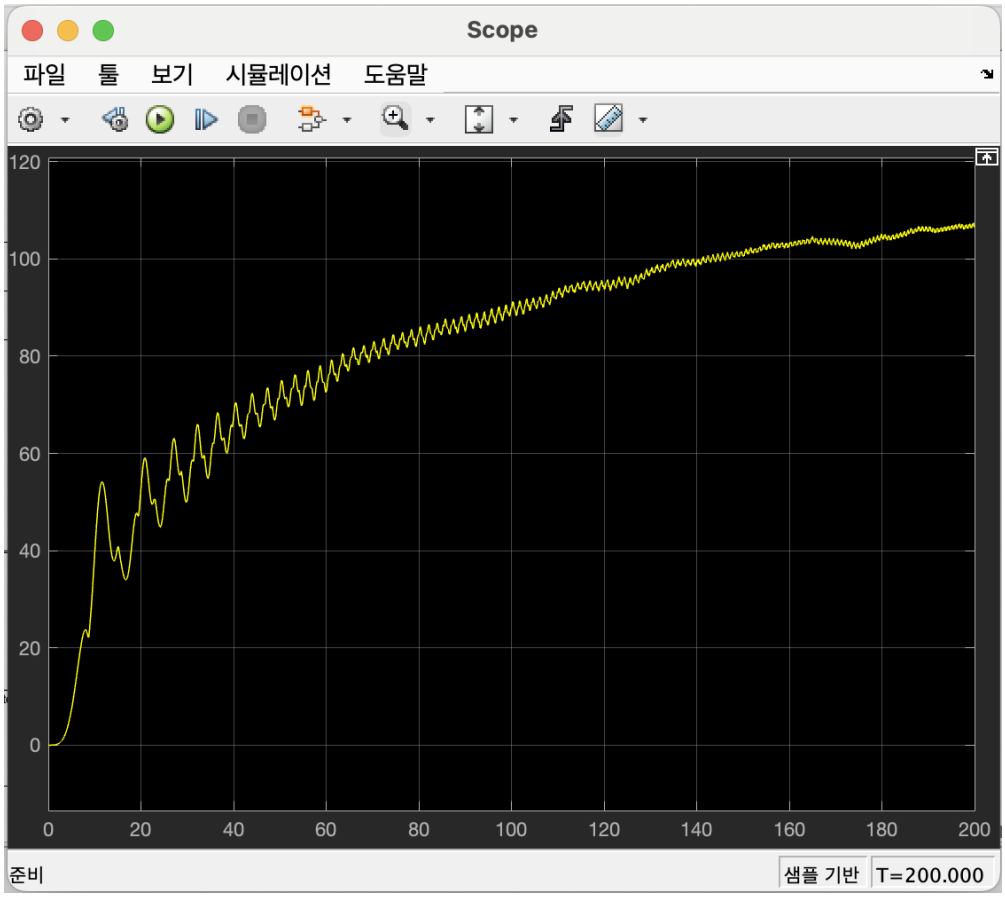

Figure 5: y position vs time with x axis momentum

Because of sudden change, the drone goes away from the starting y position, but then starts to reach a terminal y position and just keeps oscillating around that value.

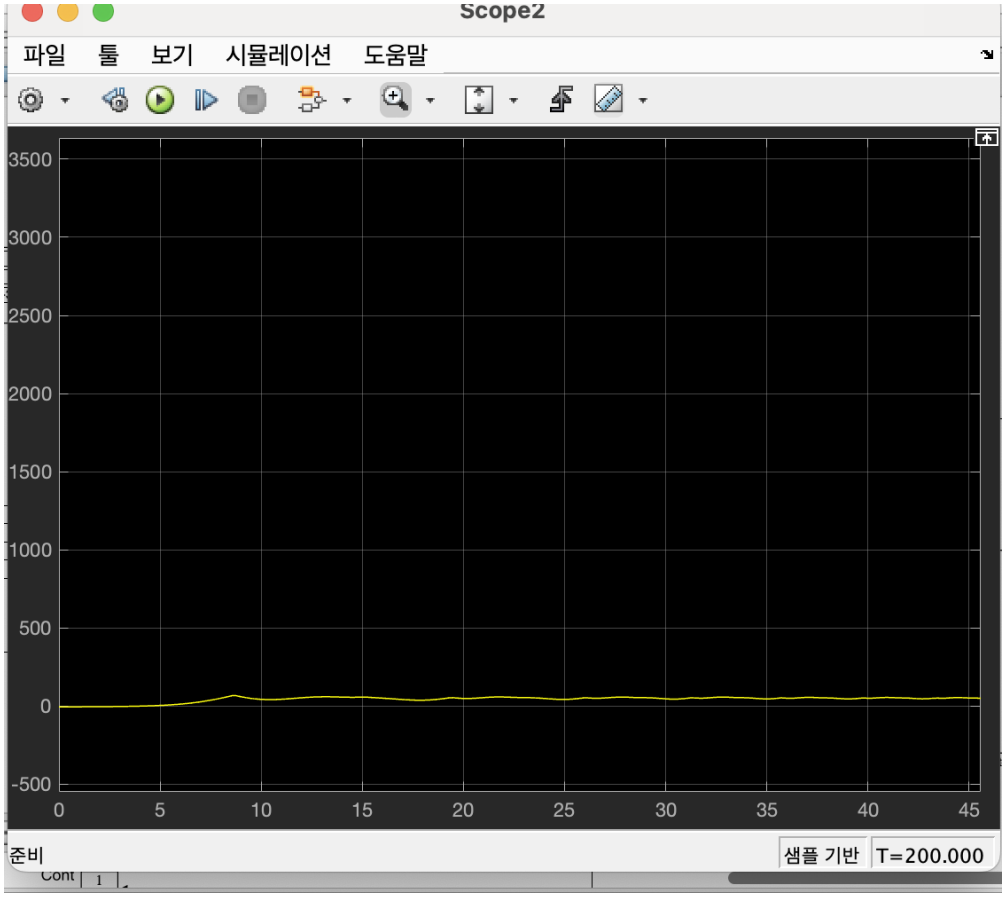

Figure 6: z position vs time with x axis momentum

The drone falls as expected but it does not fall to the ground as much as it did in the 1st problem. The reason for these could be some aerodynamic forces.

3 Problem 3

As the drone is spinning in y axis, the all motion is in XZ plane. So, the drone's y position does not change. As in the problem 2, the x position was constant and y position was oscillating, now, it is the other way around. And the drone keeps falling down during these motion.

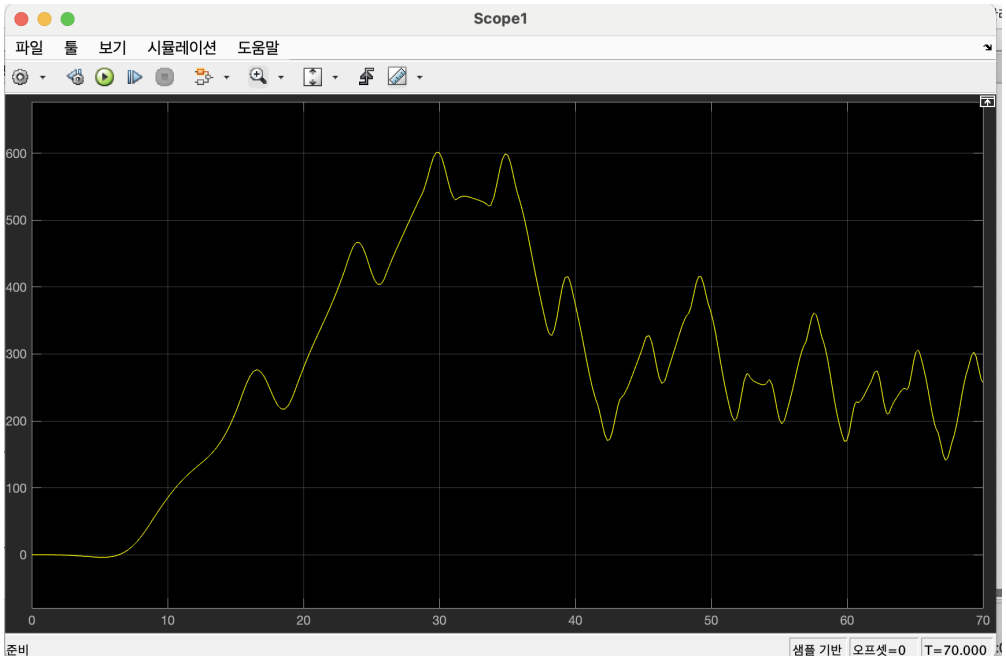

Figure 7: x position vs time with y axis momentum

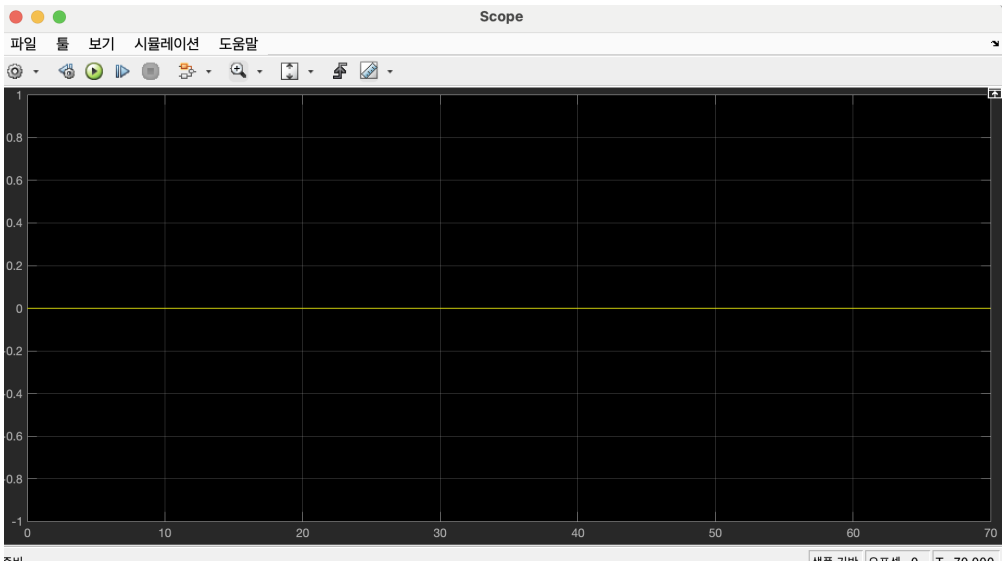

Figure 8: y position with y axis momentum

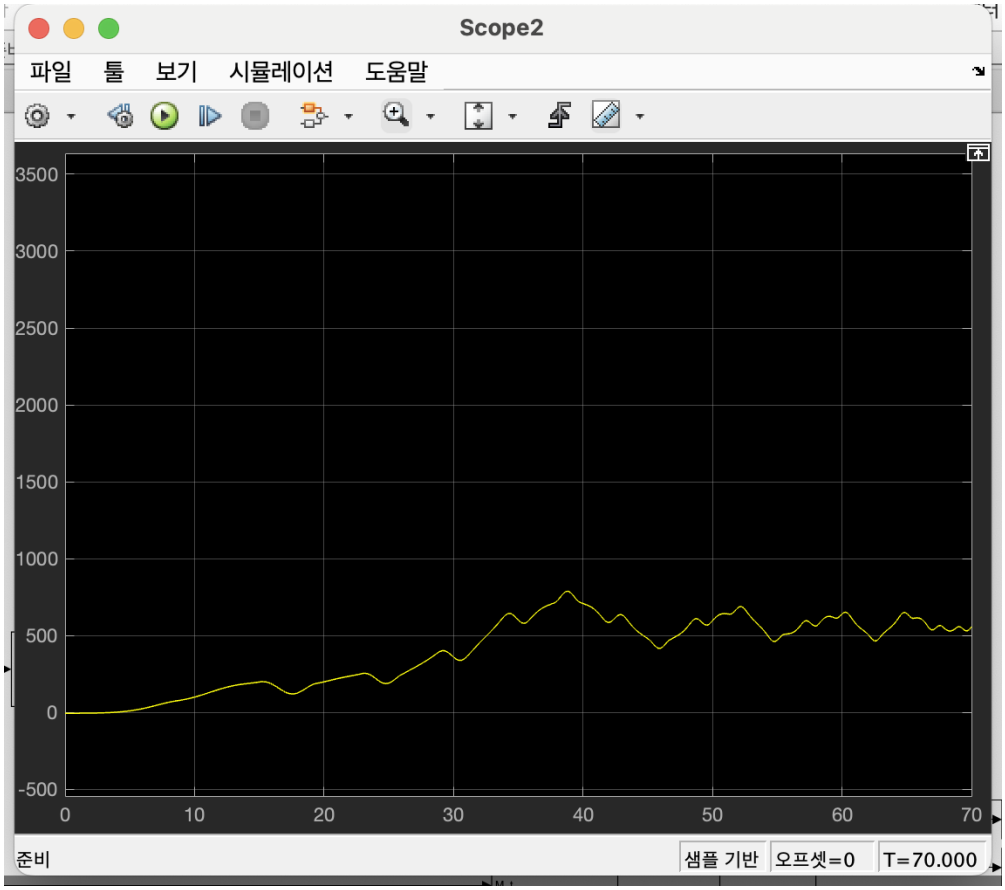

Figure 9: z axis position vs time with y axis momentum

4 Problem 4

As expected, the result of the simulation is similar to problem 1 as the only difference now is that the drone is spinning in z axis.

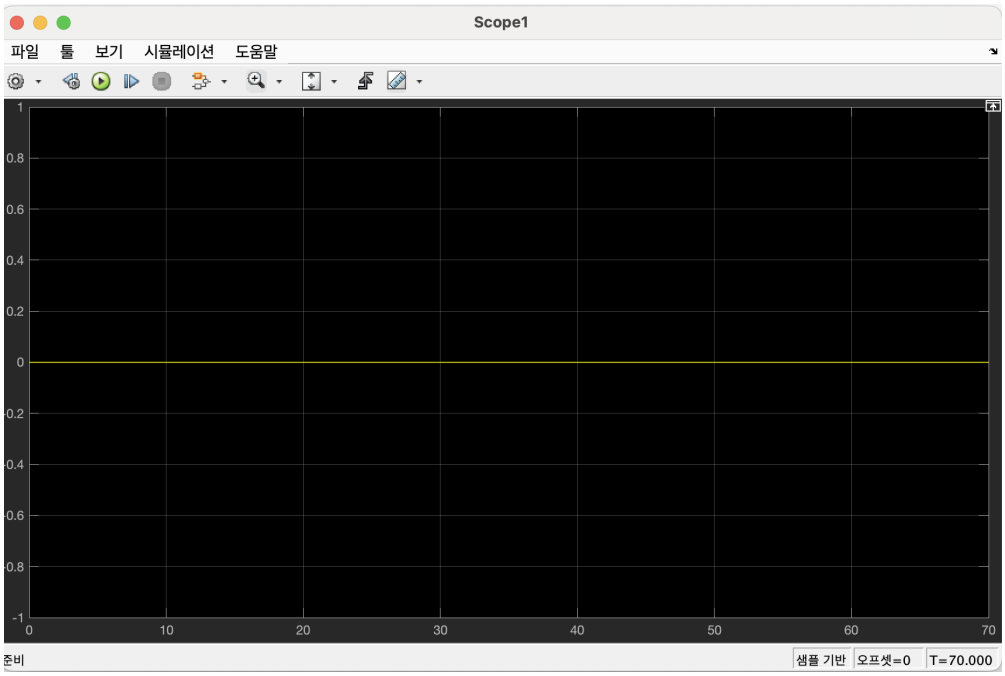

Figure 10: x position vs time with z axis momentum

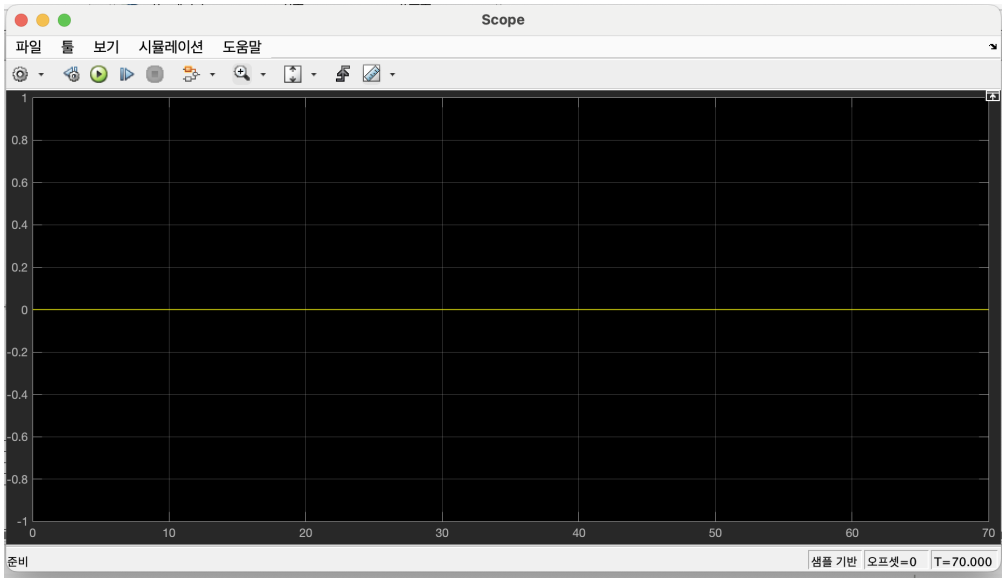

Figure 11: y position vs time with z axis position

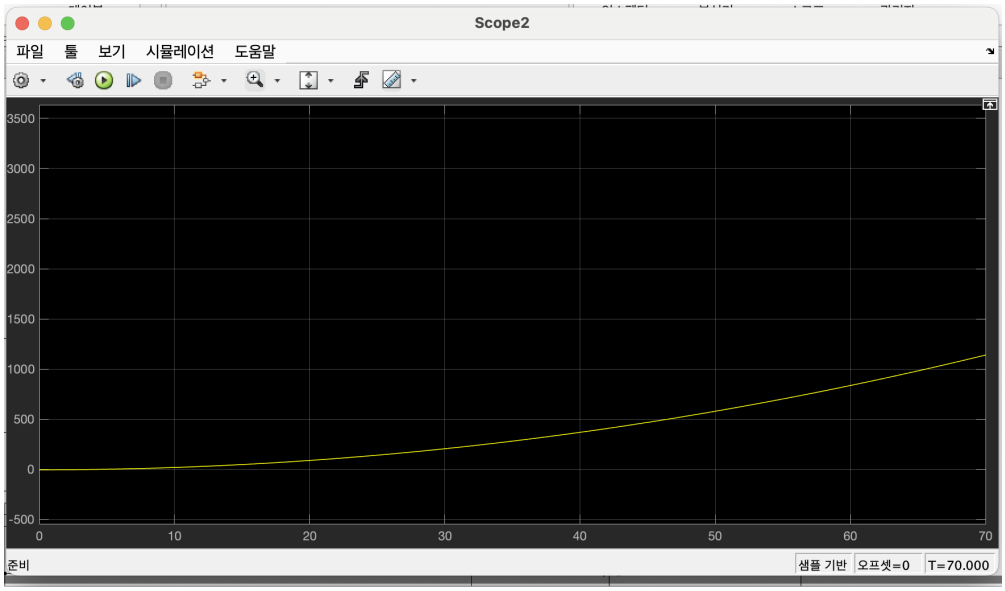

Figure 12: z position vs time with z axis momentum