Project 1

MAE 598

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The basic concept of this project was to choose at least one of these five conditions to make the rocket landing more realistic:

1. More realistic definition of state and action spaces: Rocket orientation, angular velocity, etc.
2. Better dynamical model, e.g., drag
3. Constraints in state and action spaces
4. Controller design for a distribution of initial states rather than one
5. Randomness in dynamics, sensing, etc

I chose to make the state and action space more realistic by adding an x direction and adding rocket orientation. I also added a design for the controller to have a distribution of initial states. These changes can be seen in the *forward* and *inititalize_state* functions. The original code was essentially just a free fall, with no orientation or x direction and a set initial state. The new initial state is random and the controller takes into account this randomness.

My final code:
https://github.com/zlasher18/PycharmProjects/blob/master/site-packages/Project%201.py

I started with the original sample code and changed the two functions initially stated and also added a plot for theta, along with some other stuff that had to change to make the code work.

Figures from different sets of initial conditions:

Figure 1

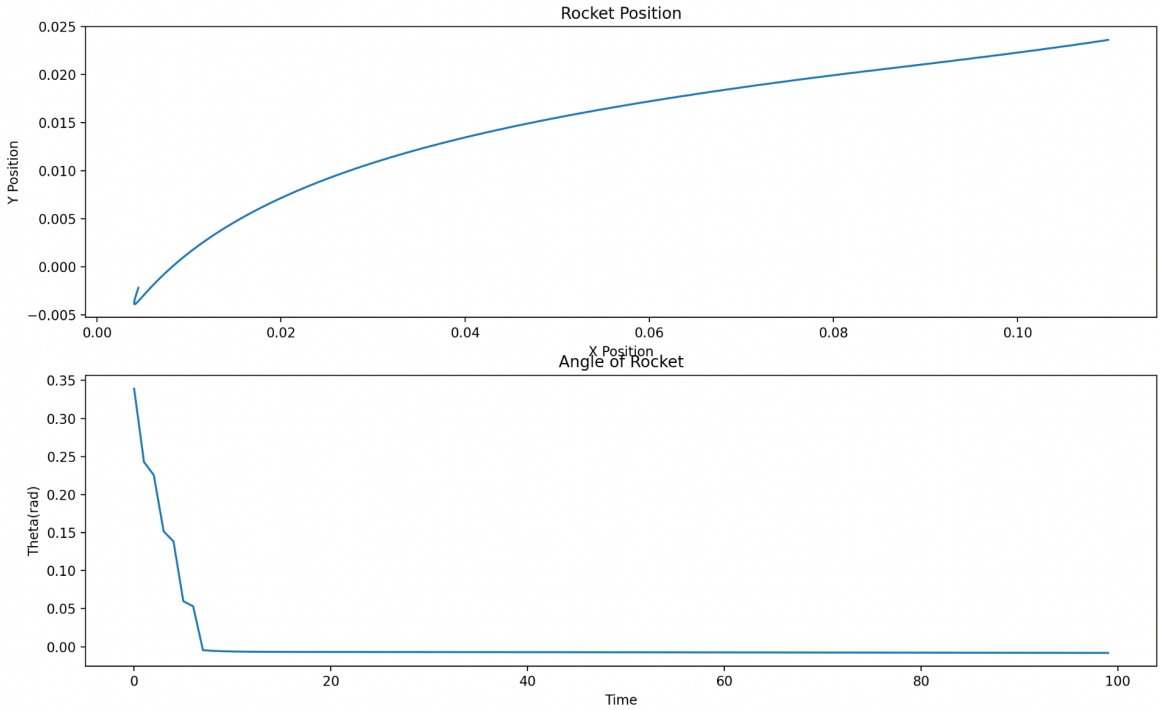


Figure 2

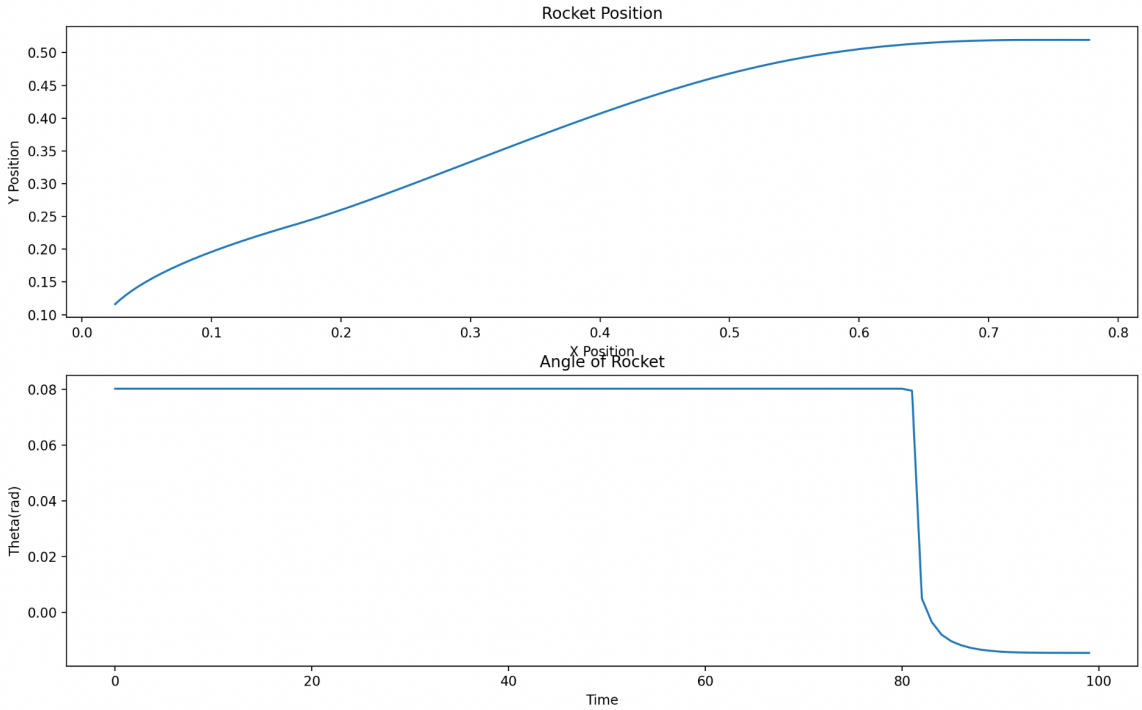


Figure 3

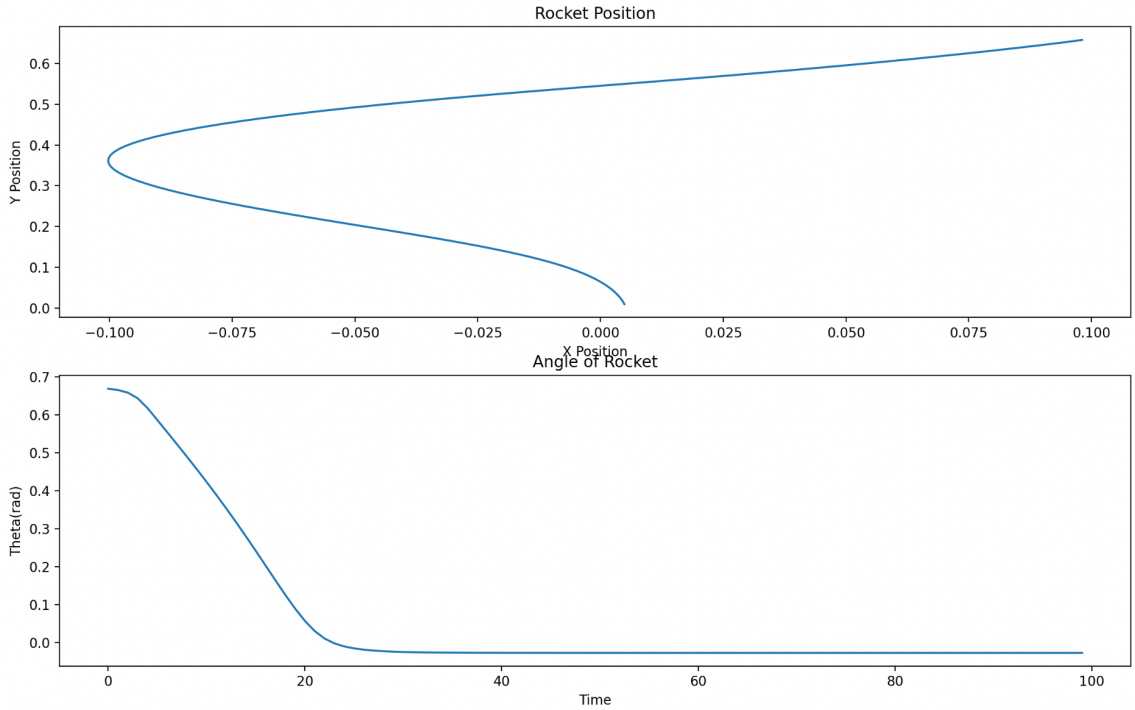


Figure 4

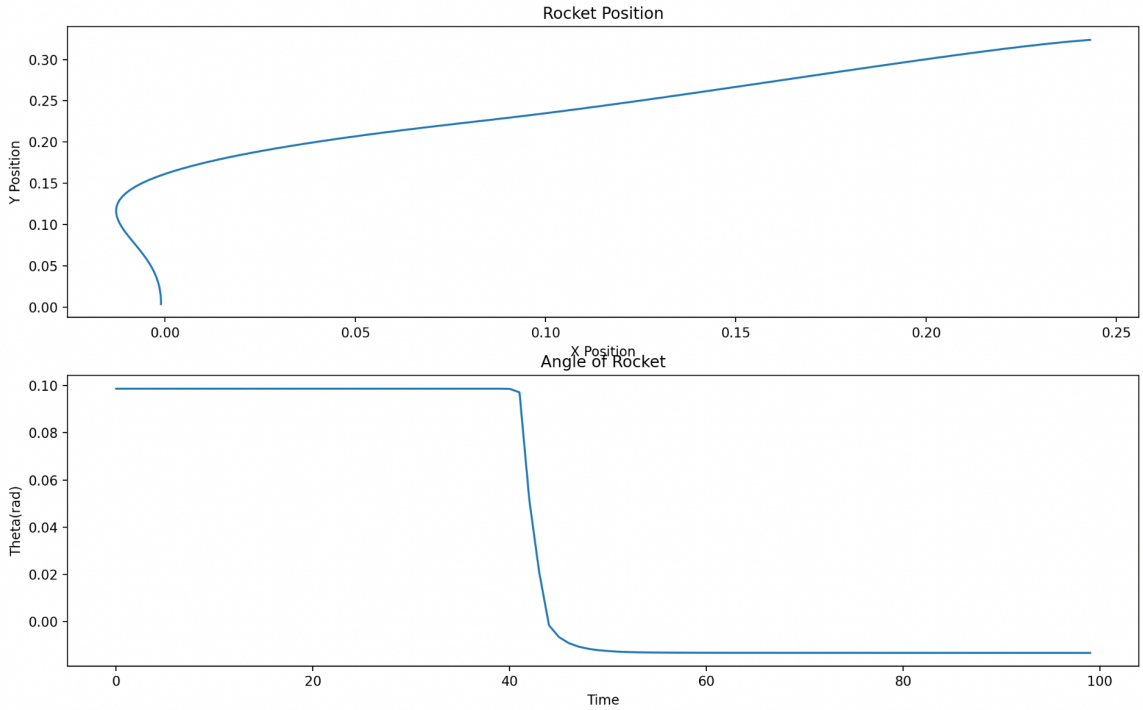


Figure 5

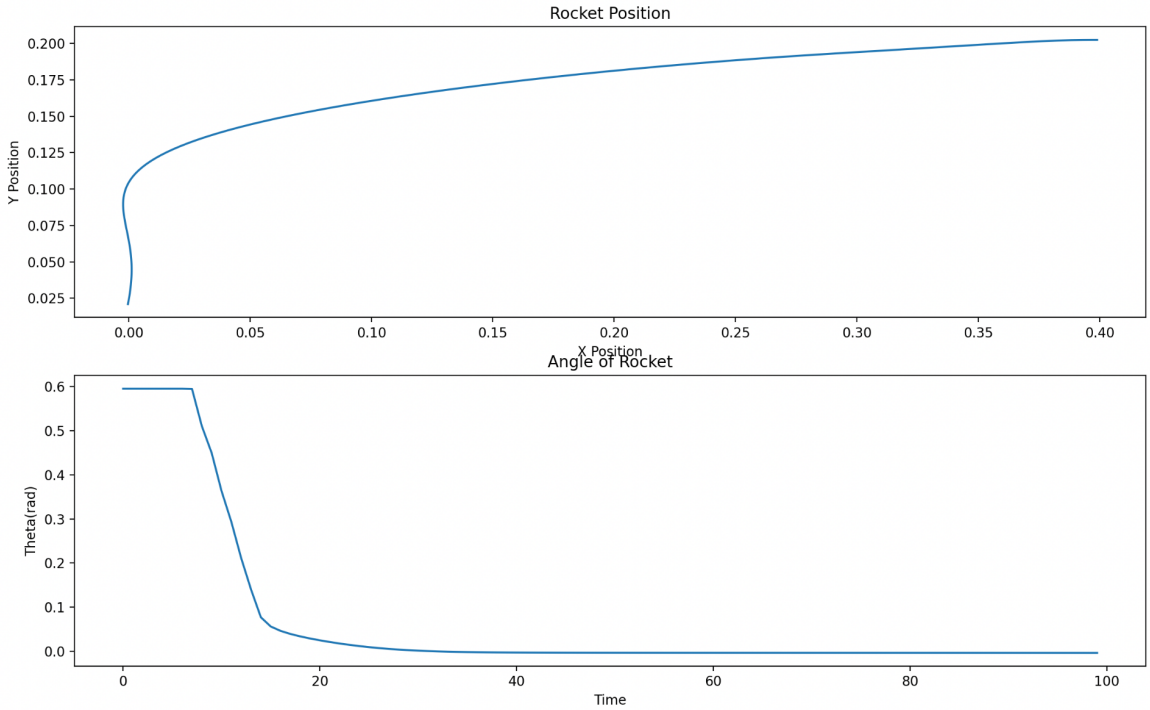


Figure 6

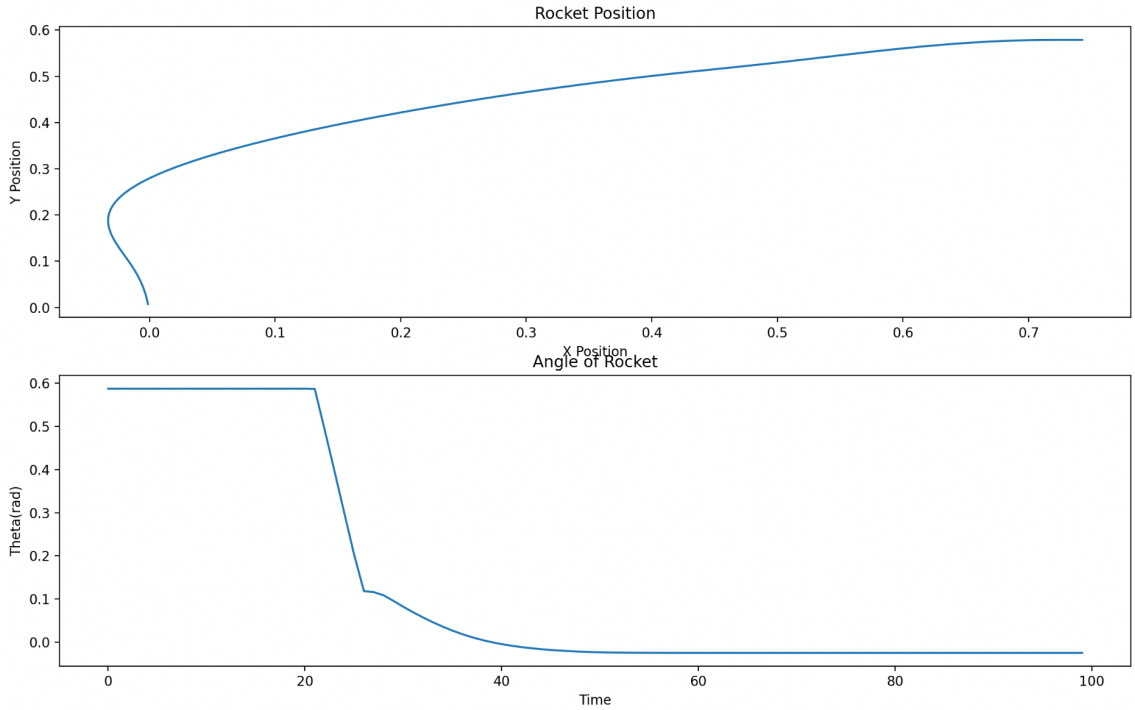


Figure 7

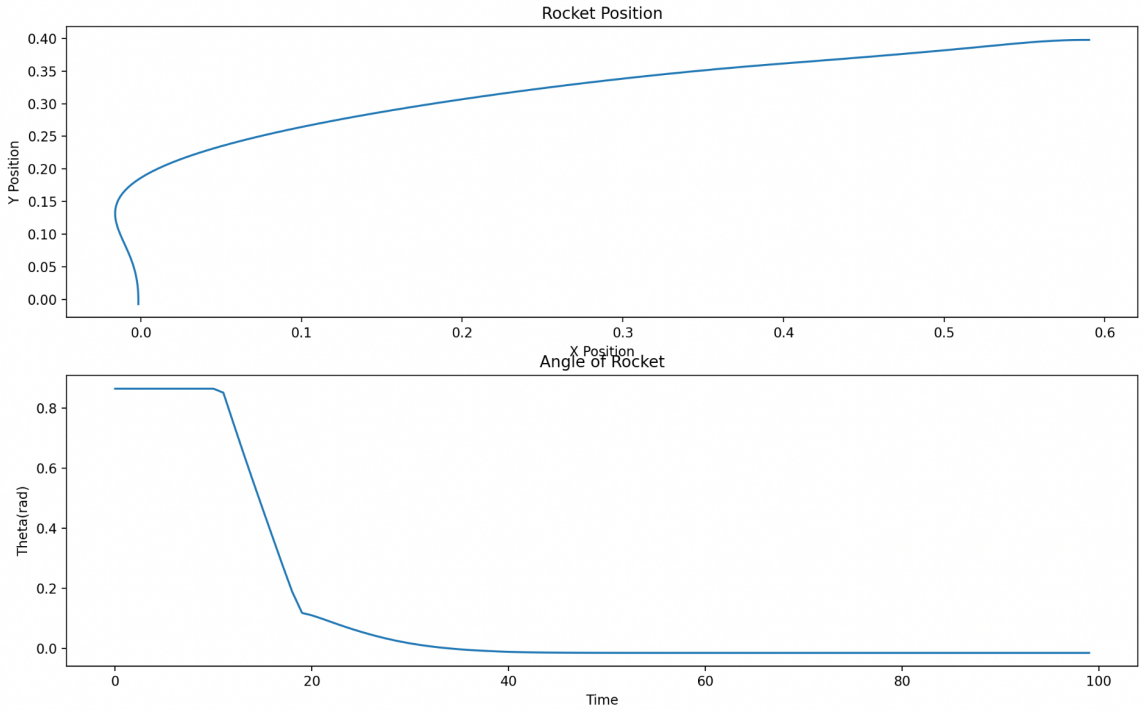


Figure 8

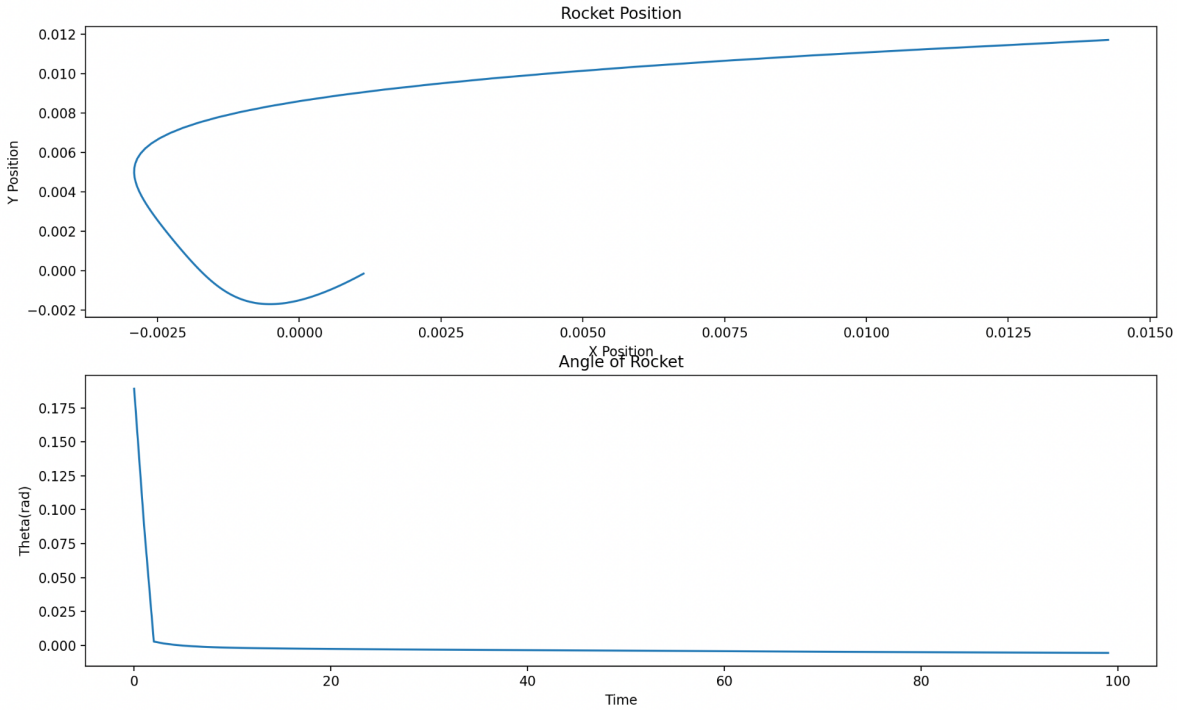


Figure 9

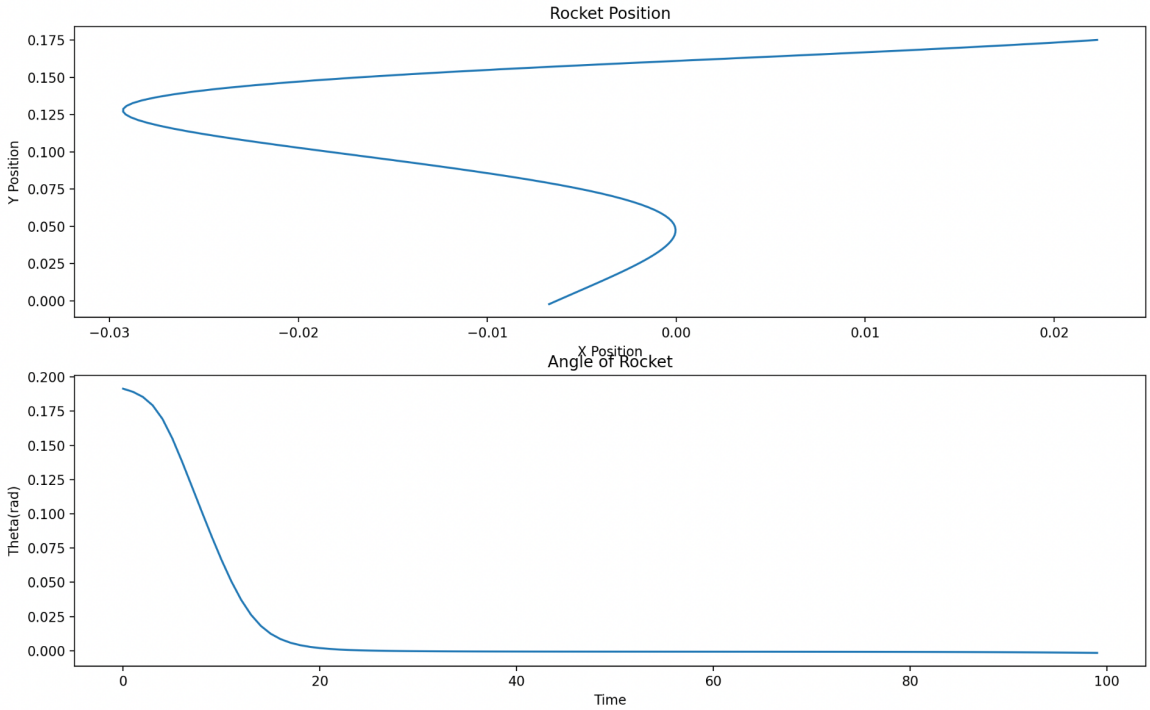


Figure 10

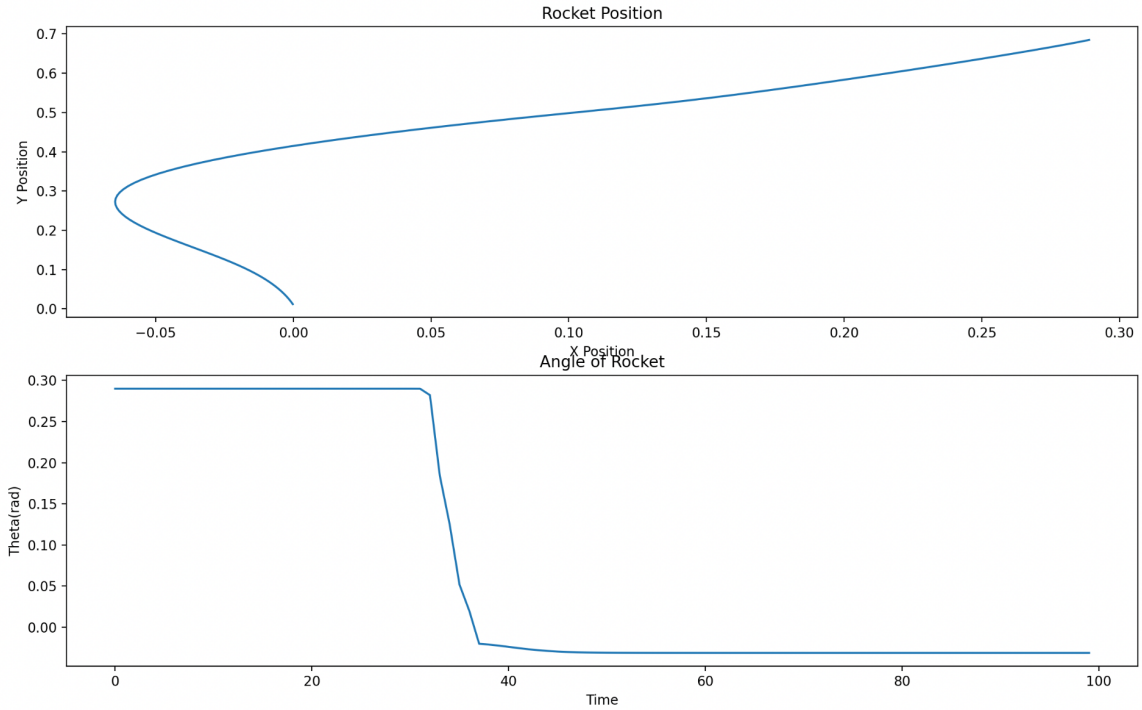


Figure 11

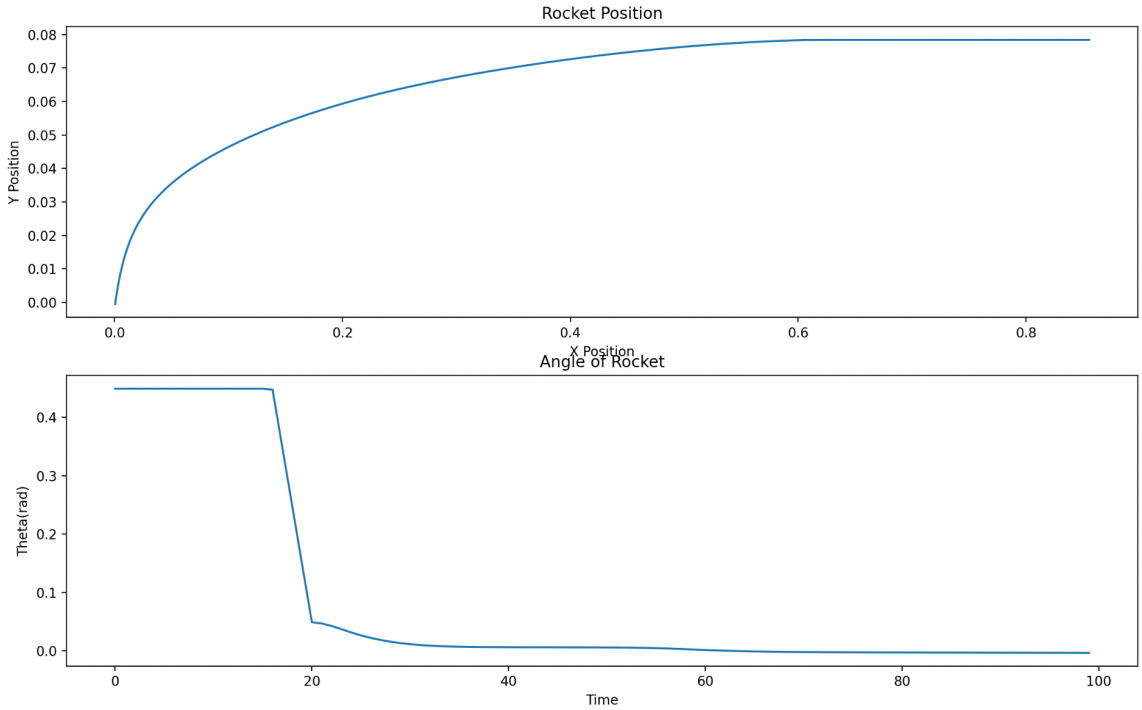


Figure 12

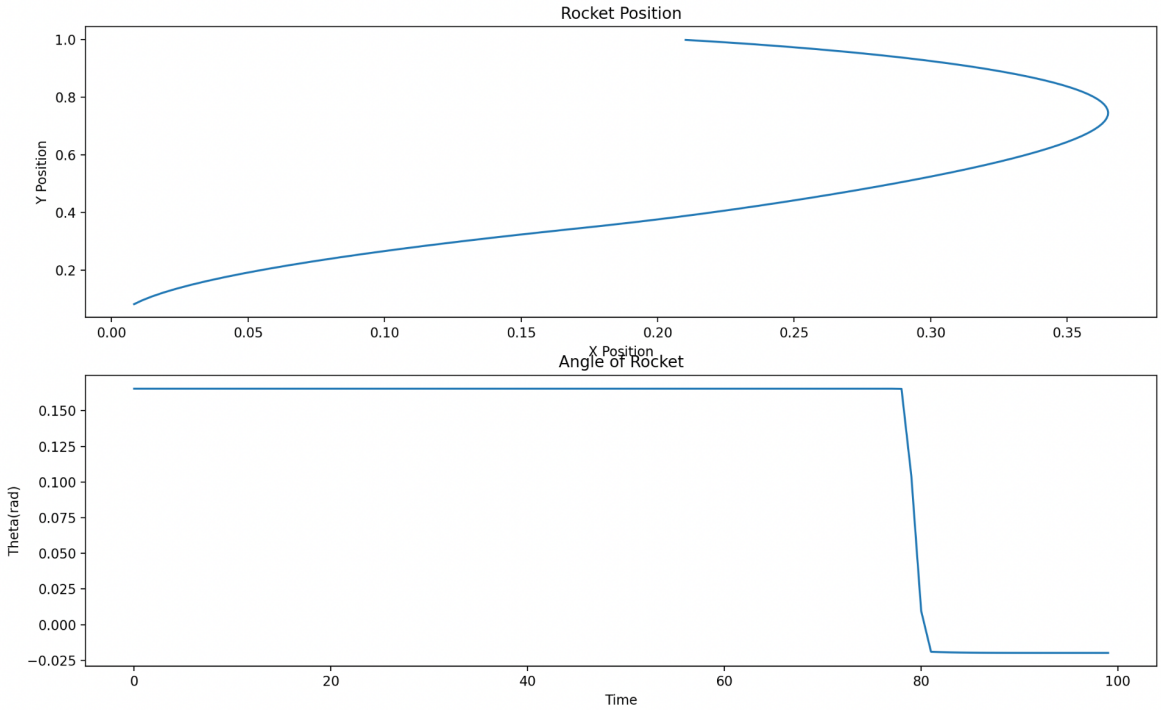


Figure 13

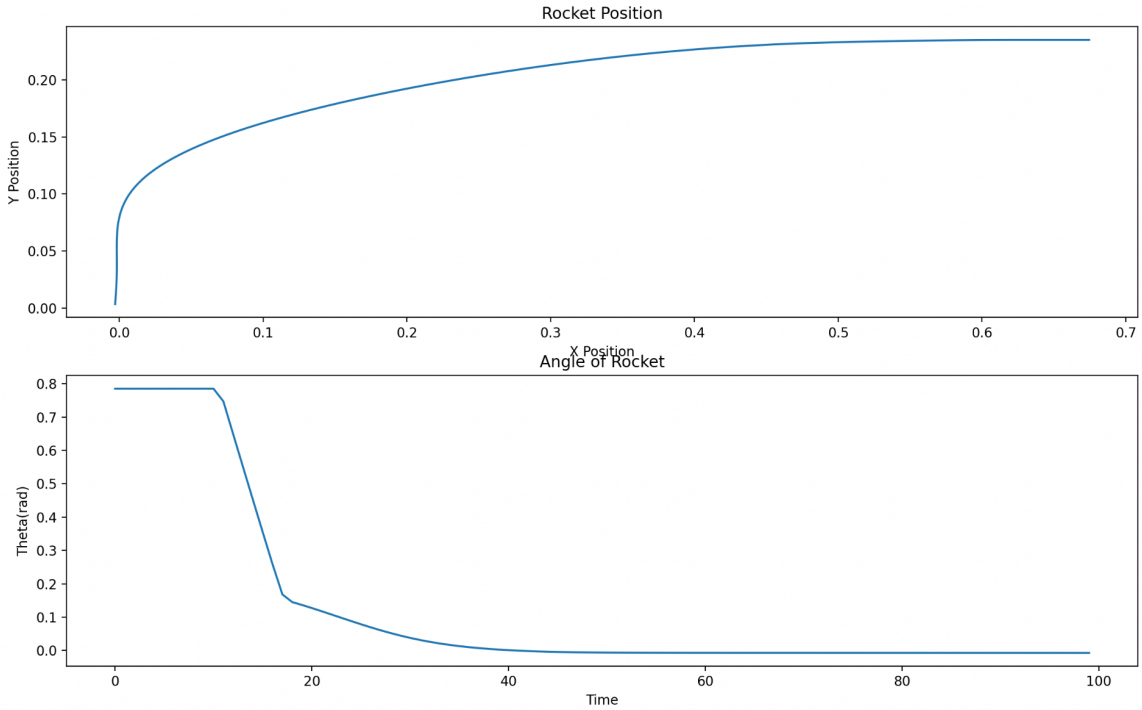


Figure 14

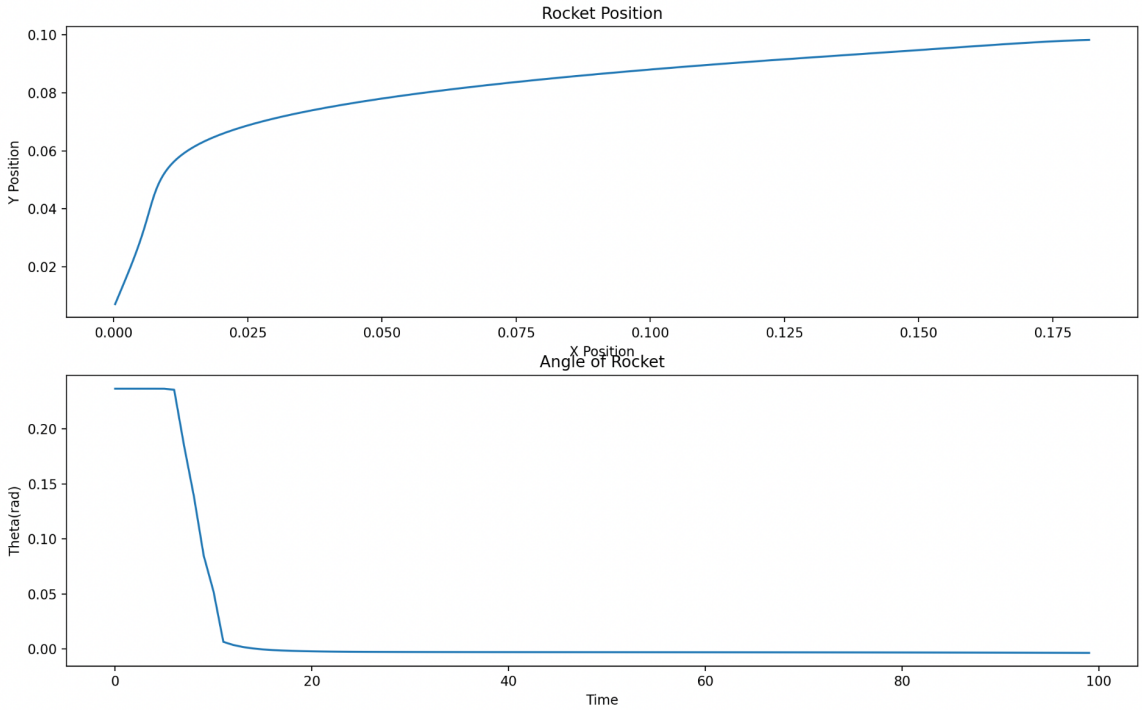


Figure 15

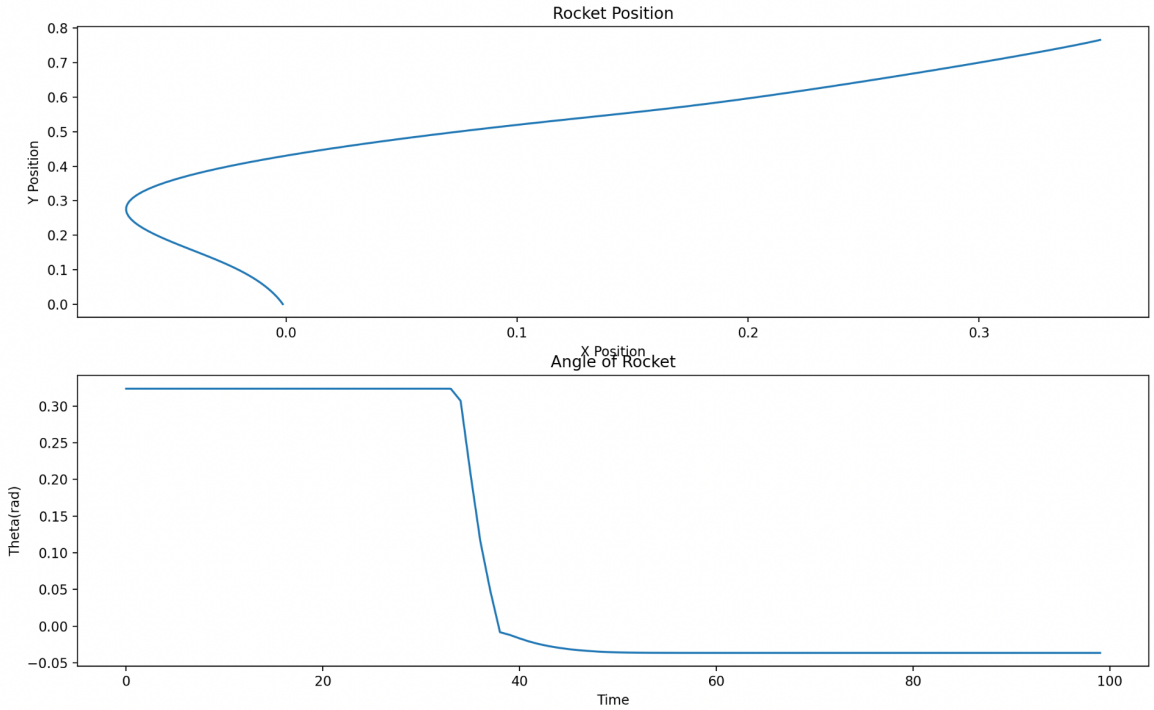


Figure 16

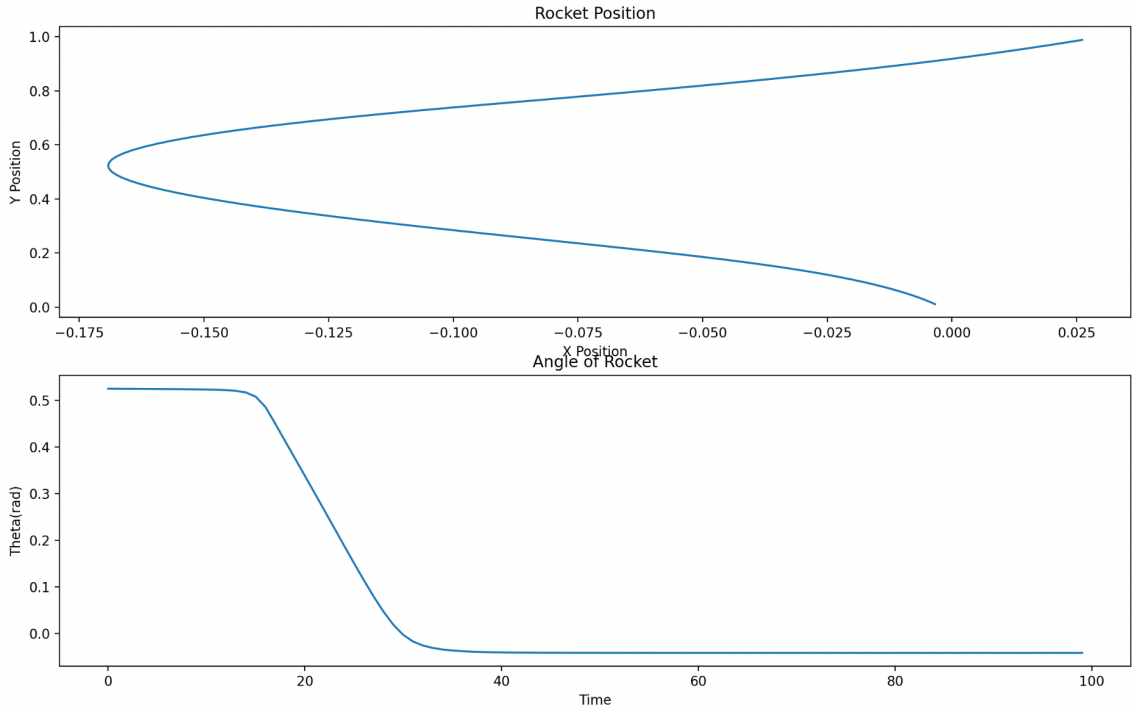


Figure 17

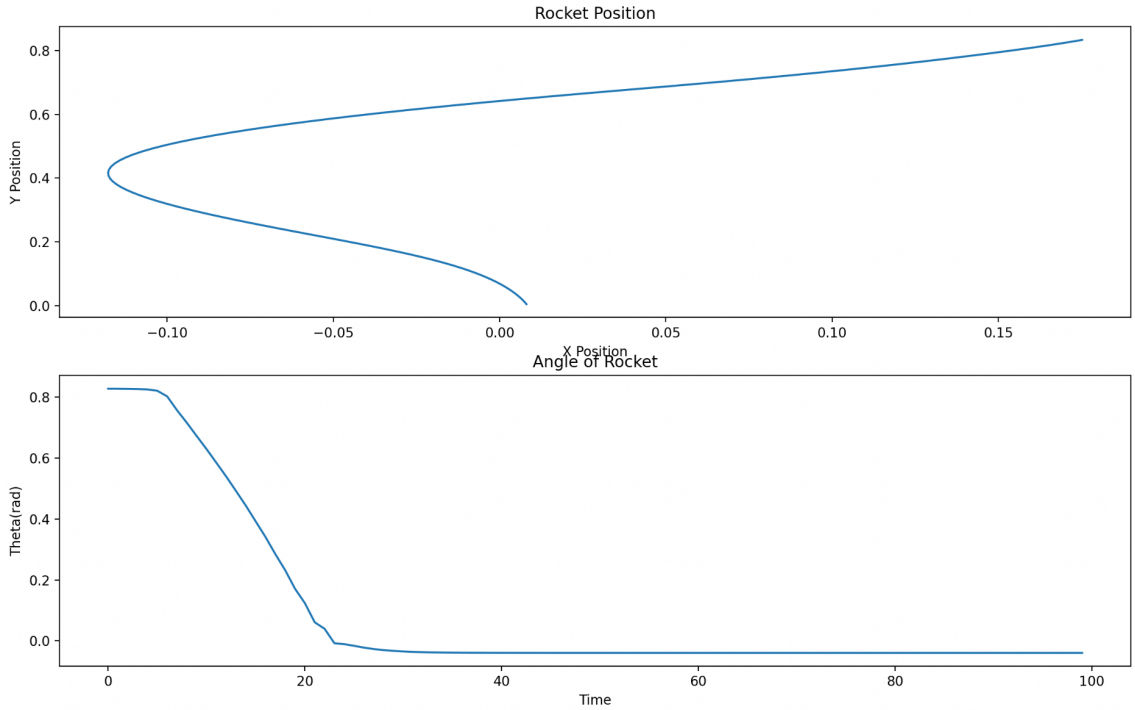


Figure 18

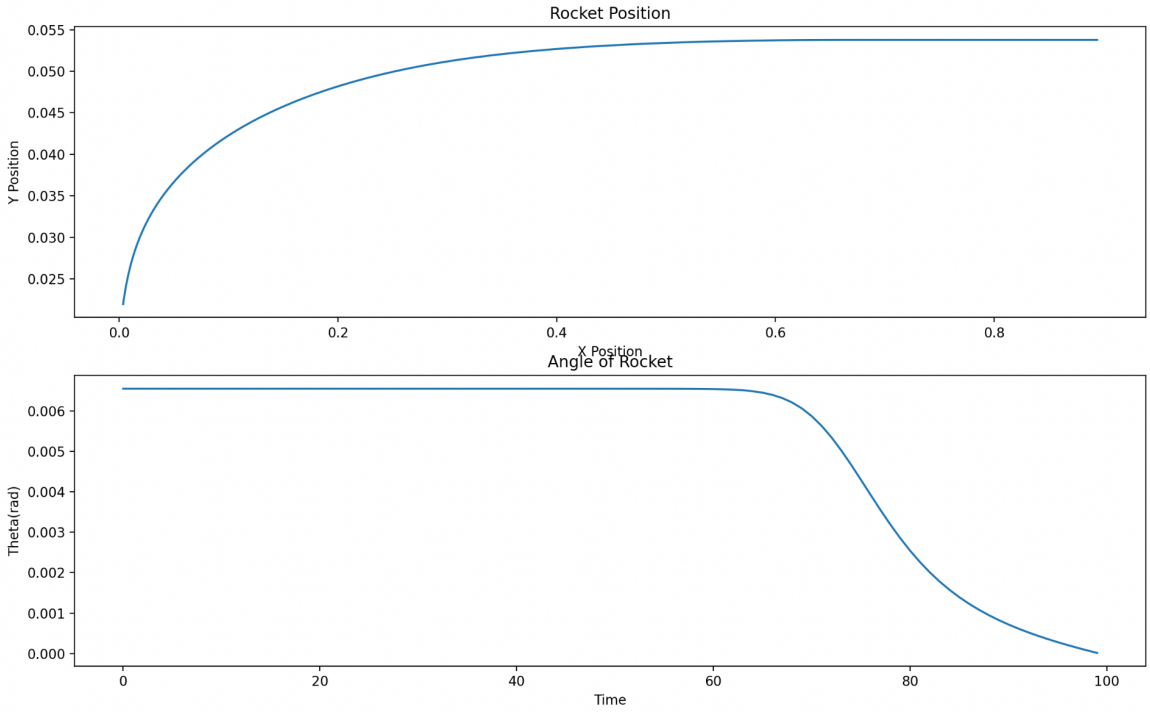


Figure 19

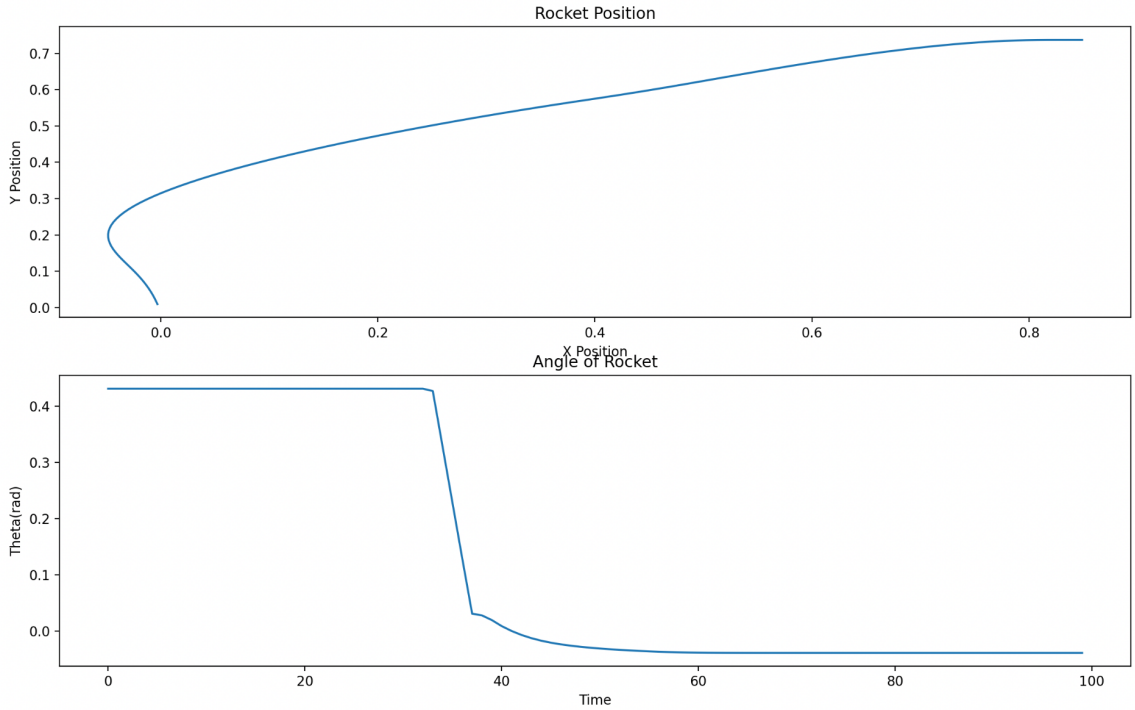
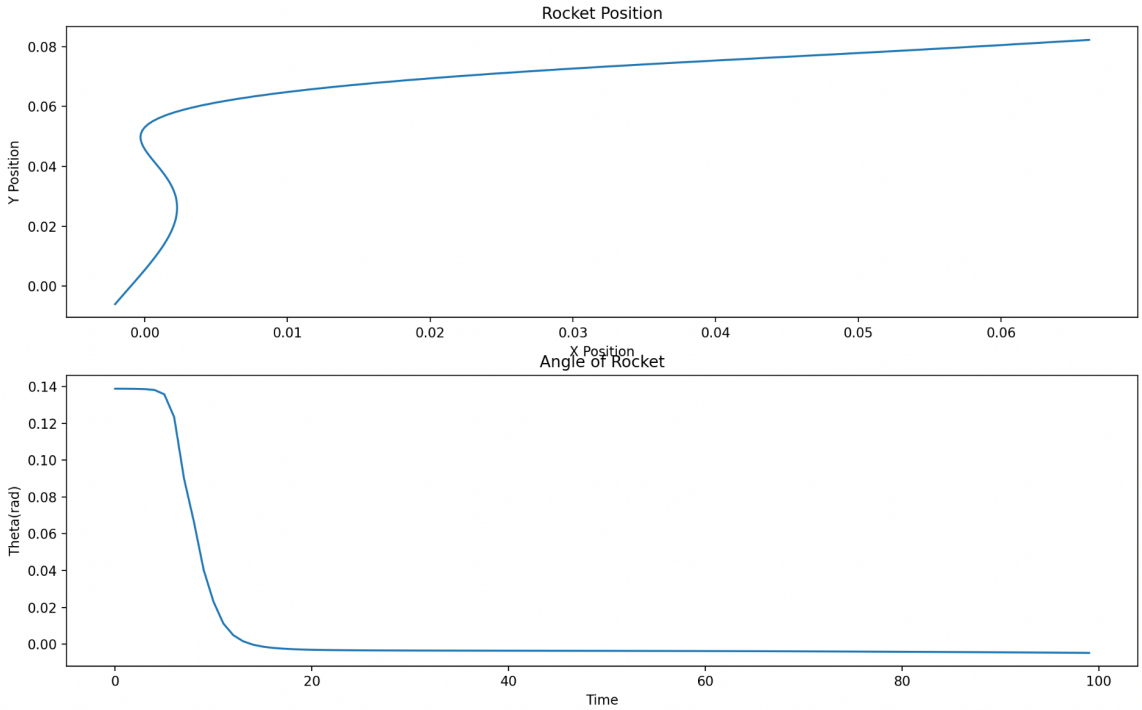


Figure 20



As you can see from the figures, the controller does bring the rocket to approximately (0,0) and 0 radians. However, there are limitations to the controller.

Limits of my controller/code:

- The dynamics are not completely correct. There is no drag or z direction and second axial tilt.
- torch.rand only gives random numbers between 0 and 1, so it cannot simulate anything more than this.
- The velocity starts at zero, this does not simulate what might actually happen if you need to land a rocket coming into the atmosphere.
- The sensors might not be perfect, and the controller would not be able to handle this.