Problem Definition and Goals

Unmanned aerial vehicles (UAV's) have been heavily researched and developed in hopes of achieving accurate aerial movements to be implemented by different robots. Achieving this level of movement could help revolutionize package delivery, prevent the death/injury of workers who work in places with high height, automate the agriculture industry, and unlock new styles of photography [1]-[2]. Our team's goal is to control the height of the UAV by controlling the force of the rotors, accounting for gravity and linear drag. The height of the UAV is a useful metric because it allows for stable control of the drone in 3D space.

Metrics

For the quadcopter altitude control system, we will test performance by tracking both a step change in height and a smooth sinusoidal height change. Essentially, $r_1(t) = Au(t)$ will be a step force input and $r_2(t) = f(t)$ where f(t) will be a time-varying force input. We will measure how quickly and smoothly the quadcopter responds, focusing on its overshoot, and the steady-state error. In addition, we will check how much motor output is required compared to the maximum (control effort) and how often the motors hit their limits.

References

[1] L. Mirto, "What's The Future of Drone Technology?," Americas, https://www.zuken.com/us/blog/whats-the-future-of-drone-technology/ (accessed Sep. 10, 2025).

[2] R. Bishoff, "10 future uses for Drones," COLLEGE OF ENGINEERING, https://engineering.osu.edu/news/2024/02/10-future-uses-drones (accessed Sep. 10, 2025).