# ME 410 – Week 7
## Christopher Luey

## (a) Text Description

**Milestone 3 – Hover Control** *(Checked in class)*

Our objective was to move the quadcopter from one checkpoint to another while maintaining stable hover via attitude control. To accomplish this, we finalized our PID gains:

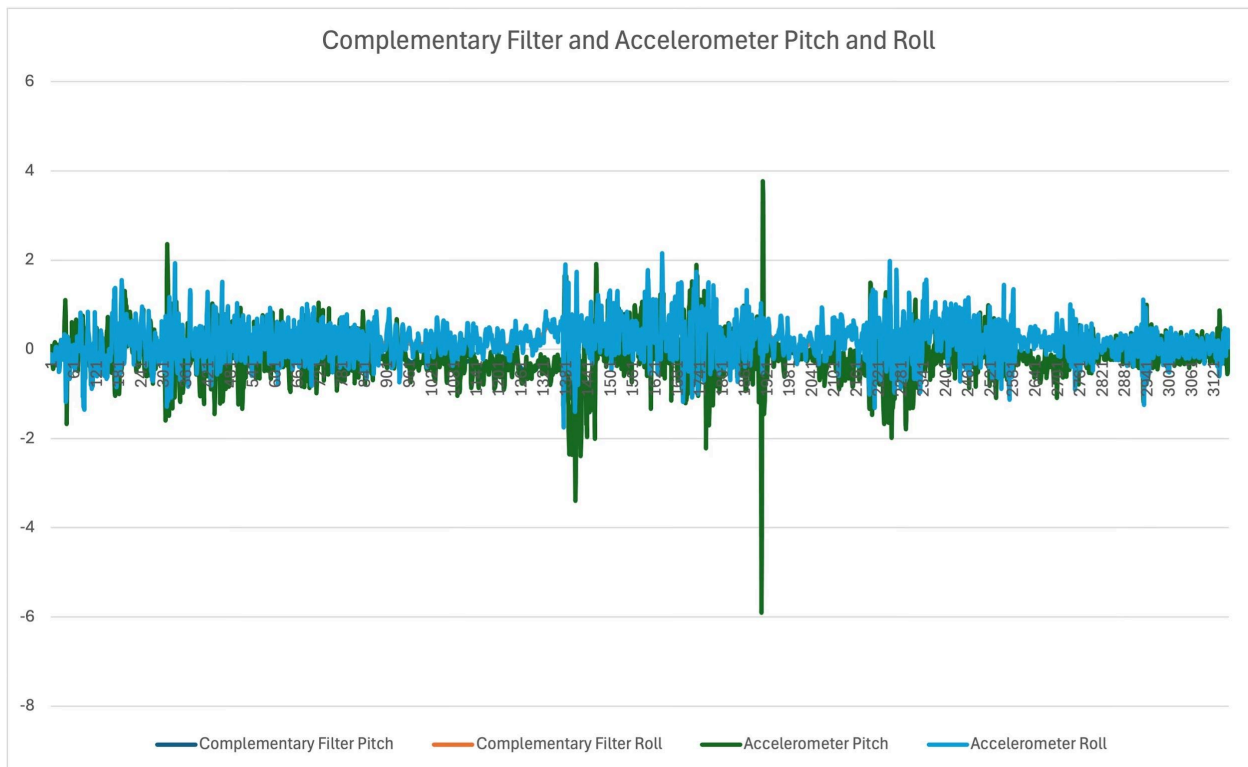- Proportional (P): 12

- Integral (I): 0.3

- Derivative (D): 2

Initially, tuning was not feasible due to erratic IMU readings. The IMU displayed extremely noisy data—oscillating between -80° to 80° during motor spin-up—which made the quadcopter uncontrollable. Through debugging, we discovered:

- An initialization error in the IMU configuration; filtering was incorrectly disabled.

- A mathematical bug in our pitch calculation — the atan2 function mistakenly used the wrong axis ratio (Y/X instead of X/Y), inverting pitch estimates.

We corrected the filtering issue by configuring the IMU's control register to 0x89, which properly enabled digital filtering. After this change, the sensor output stabilized dramatically, allowing us to proceed with PID tuning.

Complementary Filter and Accelerometer Pitch and Roll
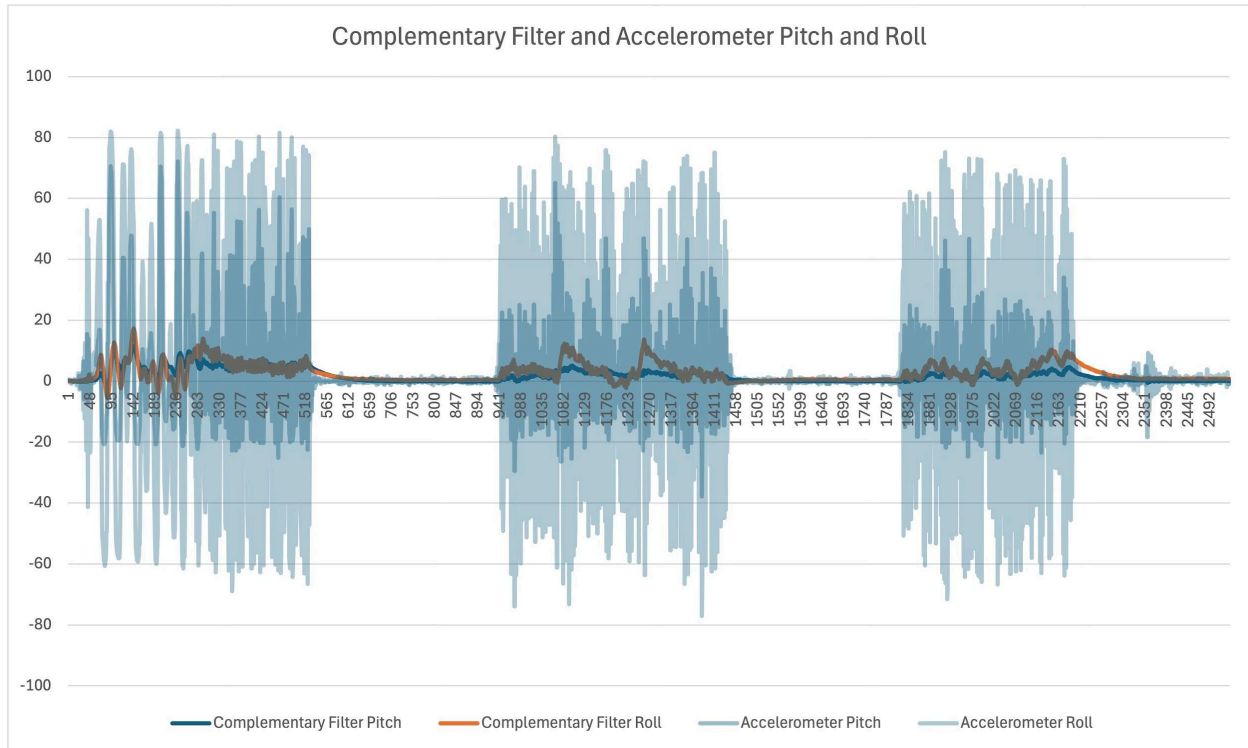
After the change, a dramatic improvement was shown:


Complementary Filter and Accelerometer Pitch and Roll

**(b) Task Assessment**

**Successes**

- We fixed the IMU bug by adjusting the filtering parameter to 0x89 upon initialization
- Control Performance: Enabled clean tuning of the attitude controller after resolving sensor issues.

**Challenges**

- *Drift:* Required slight I-gain increase to fully eliminate residual rate.
- *Battery Voltage Variability:* As the battery discharged, thrust and responsiveness dropped, requiring mid-session tuning adjustments to maintain consistent control authority.

**Planned Improvements**

- Reducing drift with integral gain tuning
- Additional practice flying

## (c) Team Member Effort

Both members were tuning and controlling together.

- **Jason (50%)**
  Performed ~2 hours of PID tuning, IMU graphing and debugging
- **Christopher (50%)**
  Performed ~2 hours of PID tuning, IMU debugging