

# Design and Control of an Inverted Pendulum System with PID Control

## INTRODUCTION

- Project Goal: Balanced system between 2 BLDC motors with PID control
- PID: Proportional-Integral-Derivative (PID) system
- Expected input for PID control: IMU sensor angle reading

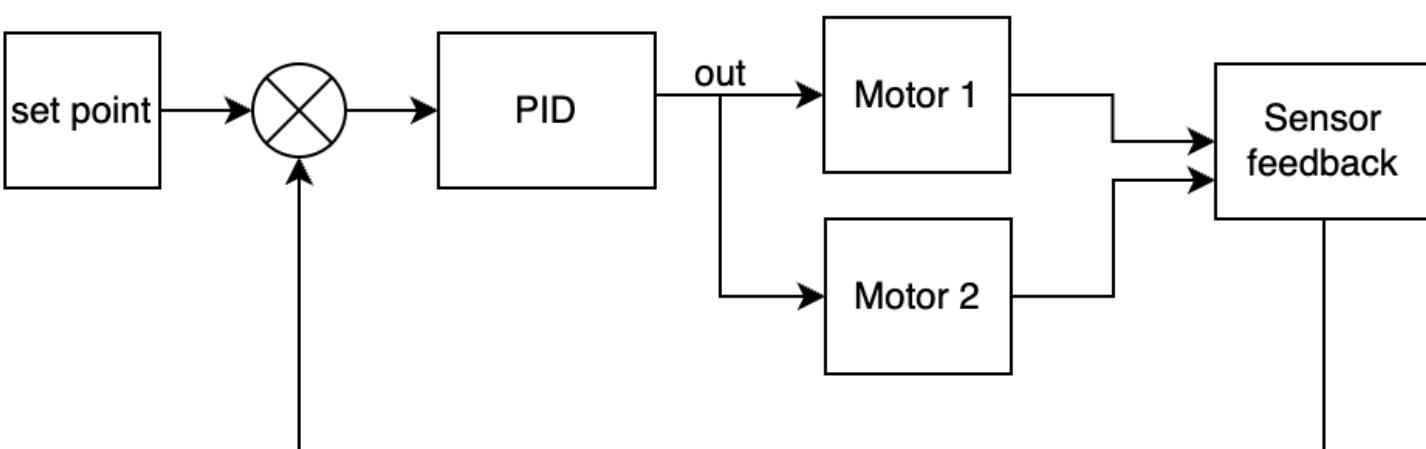
## PID CONTROLLING

IMU (Inertial Measurement Unit) sensor configures the degree how much the system is tilted and it was **roll angle** with this system.

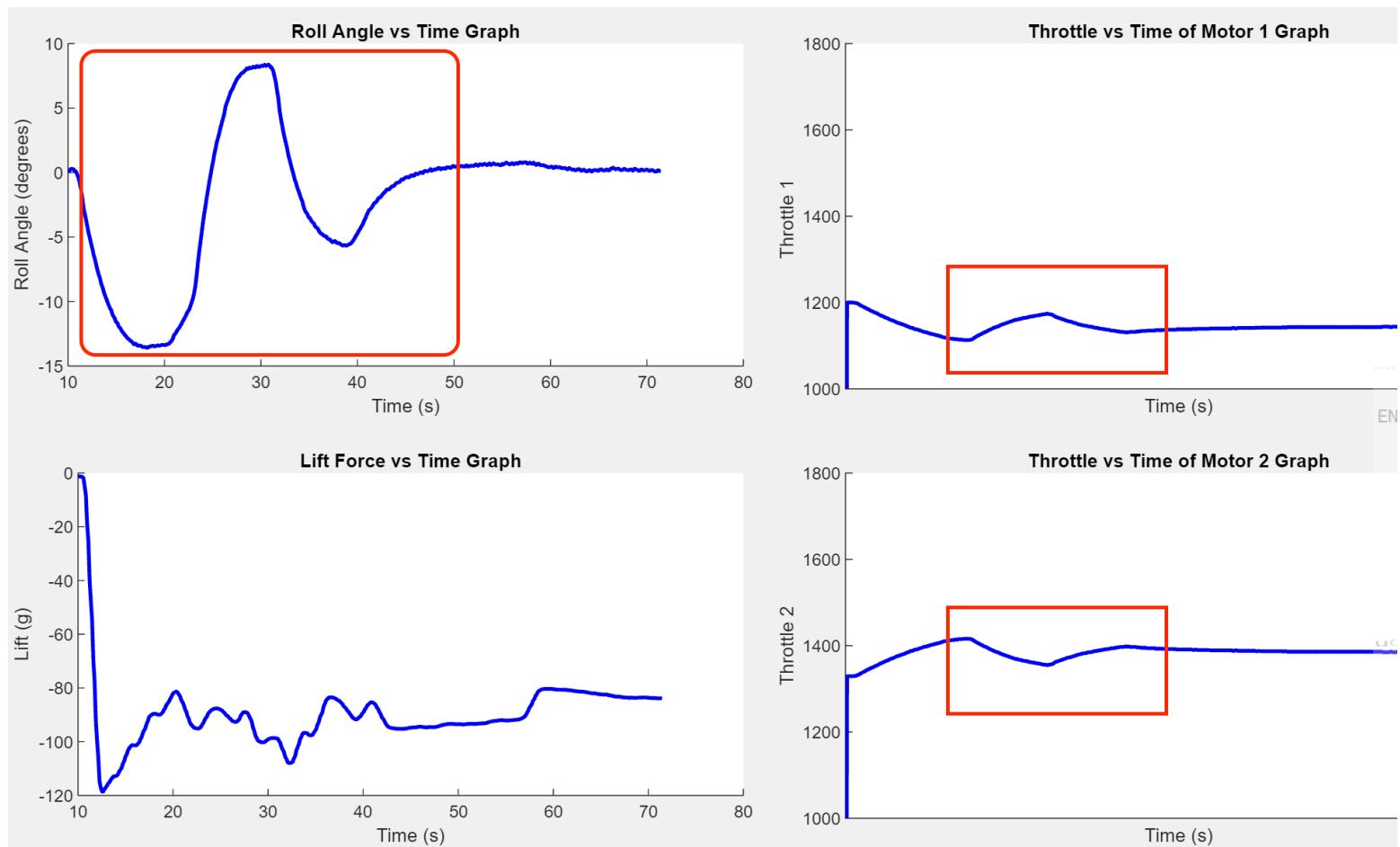
### IMU Orientation Reading

Roll:	0.06	degrees
Pitch	-0.16	degrees
Yaw	0.38	degrees

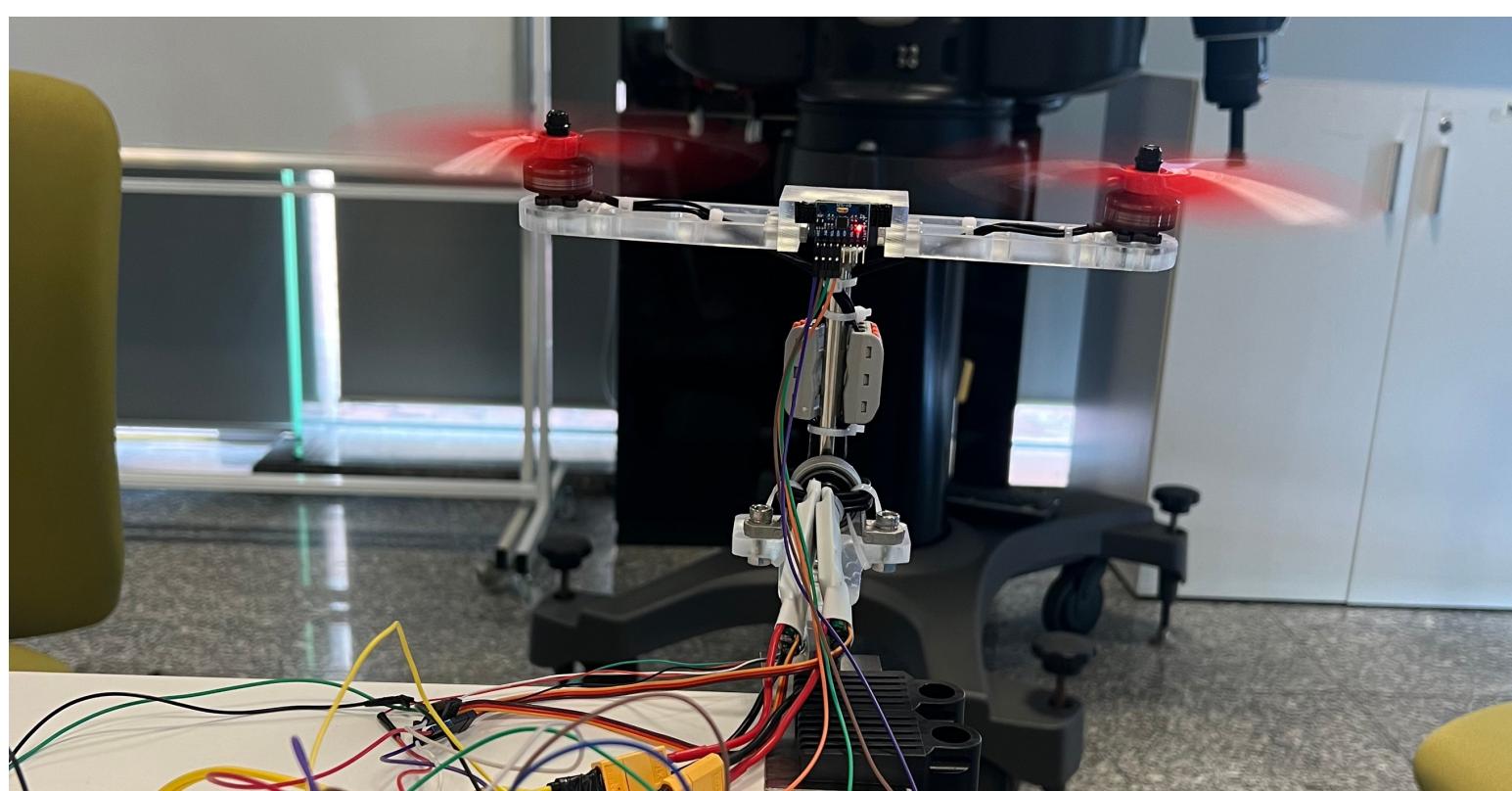
- The obtained roll angle serves as the PID system's setpoint because the goal is to achieve balance.
- The PID controller maintains equilibrium by adjusting one motor in one direction and the other in the opposite direction based on its calculations.
- If the sensor reading doesn't match the setpoint, the system automatically recalculates the motor adjustments to maintain balance.



## RESULT



- In this Graphs, the roll angle versus time's minimum and maximum values gradually converging indicates a transition toward system stability.
- It eventually settles into a stable configuration.
- There're same number of peaks between the throttle values and the roll angle graphs.
- The two throttle curves for the motors exhibit similar shapes, albeit flipped in orientation.
- This symmetry reflects the effectiveness of the PID control system, where both motors respond in a coordinated manner to maintain the system's balance.
- The PID system achieves a balanced status after 40 seconds, which is perceived as a relatively slow process.
- However, this duration marks the successful transformation of the system into an Inverted Pendulum System,



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