**Guidance Navigation Control**

**Tasks to be done:**

* Kalman filter + sensor fusion in Simulink
* PID control system for controlling pitch and yaw angle
* Altitude estimation using different algorithms
* 6 DOF rocket in Simulink
* Control system for fin/canards control
* Rocket Trajectory Simulation

1. **Kalman Filter + Sensor Fusion in Simulink**

End Goal: Estimate an accurate rocket state.

Use the sensor blocks and Kalman filter in simulink.

Get the output – position, velocity, angle of rocket, altitude.

Tip: Try EKF for non linear models if 1-KF doesn’t work properly.

1. **PID Control System for Pitch and Yaw**

End Goal: Stabilize or guide the rocket’s pitch and yaw based on attitude errors.

1. **6 DOF Rocket Model in Simulink**

End Goal: Simulate realistic rocket motion in 3D space (translation + rotation)

Use the Simulink 6 DOF block, also check out https://www.youtube.com/watch?v=sEzRzkGRpDQ&t=4s

1. **Altitude Estimation using Different Algorithms**

End Goal: Compare the accuracy of various altitude estimation methods with KF or different algorithms. Should read 10000feet.

Note: It is needed because we need to achieve 10000 feet accurately, based on which the control system will work. 10000 feet is the reference. This altitude estimation will vary.

1. **Control System for Fin/Canards Control**

End Goal: Physically steer the rocket using fins (via actuator model)

Note: also see how to apply airbrakes with fins.

1. **Rocket Trajectory Simulation**

End Goal: Visualize and predict the rocket's trajectory in 3D

* Use 3D Animation toolbox or the Aerospace Toolbox
* Plot:
  + Path in 3D (XYZ)
  + Altitude vs time
  + Pitch/Yaw angles over time

Testbench:

Add wind disturbances and noise to verify the control logic.

**Temporary State Model:**

[Sensor Model + Noise]

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[Sensor Fusion (Kalman Filter or any filter)]

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[State Estimation: Position, Velocity, Attitude, acceleration, angle]

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[Guidance Algorithm: Target Trajectory]

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[Control System: PID for Pitch/Yaw]

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[Actuator Model: Fin control]

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[Rocket 6-DOF]

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[Trajectory Output & Altitude visualisation in plots or animation]

**Deadline:** *15-08-2025 (will postpone or even prepone depending on my mood* *😁)*