IMU CODING/DECODING

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Step 1: Initial Acceleration

- **From 0 to 20 m/s in 10 seconds**:
  - **Acceleration is constan**t: ax=Δv / Δt = (20−0) / 10=2 m/s ^ (2)
  - **y-axis acceleration**: ay=0 m/s ^ (2) (no lateral movement during straight-line acceleration).

Step 2: Constant Speed (Straight Motion)

- **20 m/s for 10 seconds**:
  - Acceleration:

    ax=0 m/s^(2) ,ay=0 m/s ^ (2)

Step 3: Turning Motion

- **Turn radius = 100 m, constant speed = 20 m/s**:
  - **Centripetal acceleration (lateral)**: ay=v^(2) * r=202100=4 m/s^ (2)
  - **Longitudinal acceleration**: ax=0 m/s^(2)
  - **Angular velocity (ω\omegaω)**: ω=v / r =20 / 100 = 0.2 rad/s

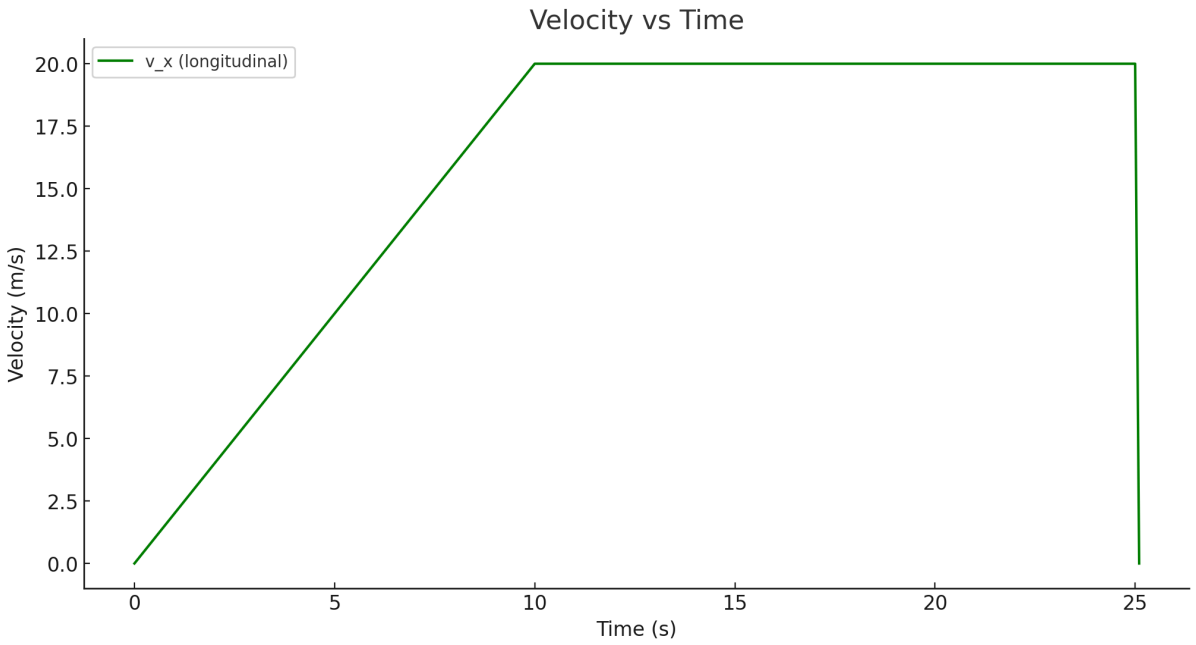
Step 4: Deceleration

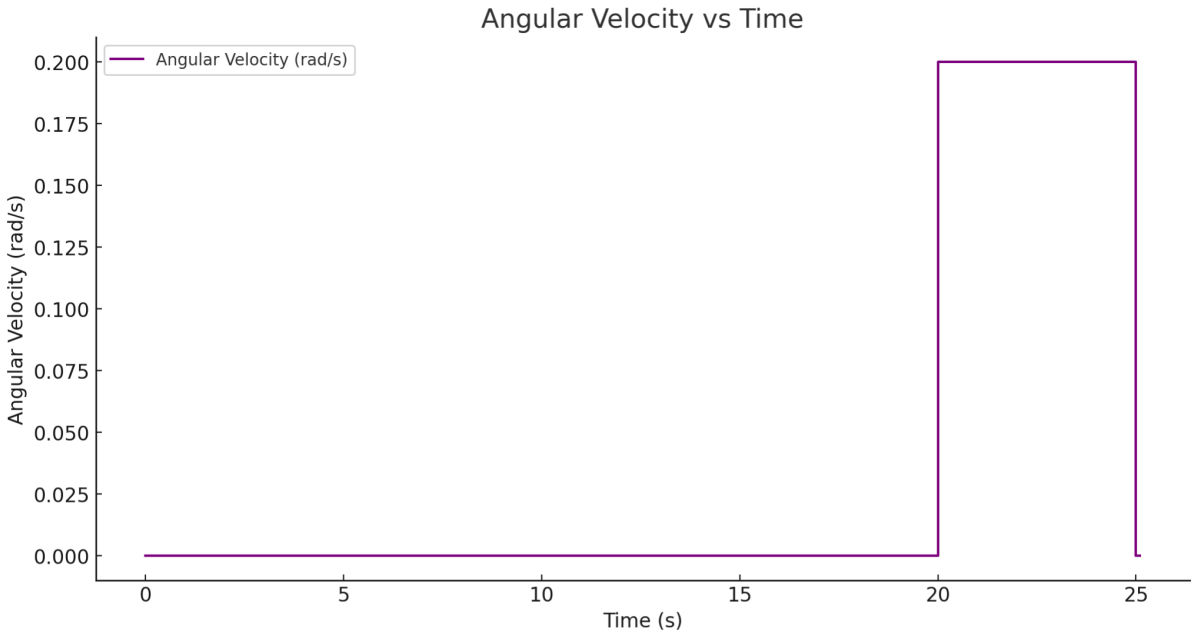
- **Stop in 1 meter**:
  - Initial speed: v=20 m/s, distance: d=1m
  - Using: v ^(2) = u ^ (2) +2 * a * s

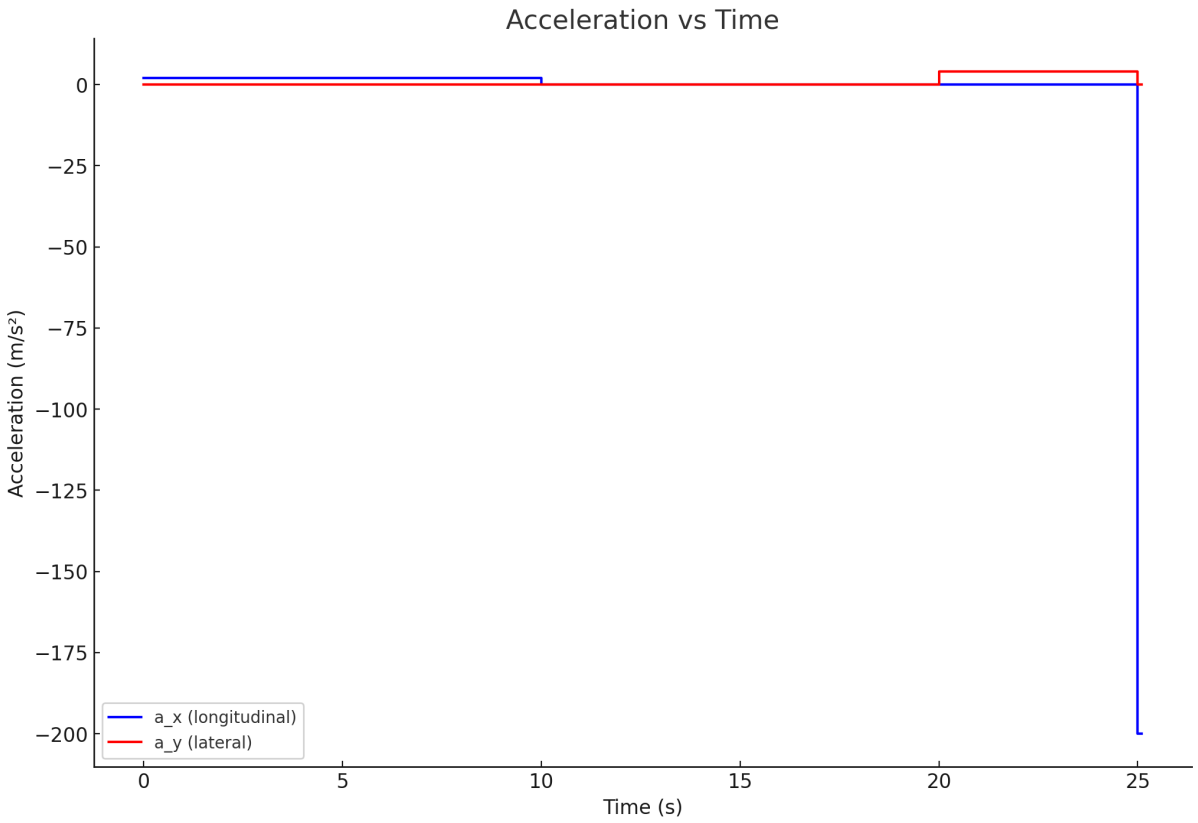
    0=20 ^ (2) +2 * a (1)

    ax=−200m/s ^ (2)

  - **Time to stop**: t=Δv / a=20 / 200=0.1 seconds
  - **y-axis acceleration**: ay=0 m/s ^ (2)


Velocity vs Time
v_x (longitudinal)
Velocity (m/s)
Time (s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
0
5
10
15
20
25


Angular Velocity vs Time
Angular Velocity (rad/s)
Angular Velocity (rad/s)
Time (s)
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0
5
10
15
20
25



The plots represent the acceleration, velocity, and angular velocity as functions of time based on the provided scenario:

1. **Acceleration (x and y axes)**:
    - Longitudinal acceleration (axa_xax) starts at 2 m/s² during the initial acceleration phase, drops to 0 during constant speed and turning, and then becomes -200 m/s² during the deceleration phase.
    - Lateral acceleration (aya_yay) is 4 m/s² during the turn and 0 otherwise.
2. **Velocity (x-axis)**:
    - The longitudinal velocity (vxv_xvx) increases linearly during acceleration, remains constant at 20 m/s during both the constant speed and turning phases, and drops sharply to 0 m/s during deceleration.
3. **Angular Velocity**:
    - The angular velocity (ω\omegaω) is constant at 0.2 rad/s during the turning phase and zero elsewhere.