Question2

September 25, 2025

1 Question 2: Calculate Kinetik Energy

[1]:
```
import numpy as np
```

Import data:

[11]:
```
theta_deg = np.array([5, 10, -3]) # Yaw ( ), Pitch ( ), Roll ( )
theta_rad = np.radians(theta_deg)
theta_dot_deg = np.array([-1, 1, 4]) # Yaw rate (d /dt), Pitch rate (d /dt),␣
↪Roll rate (d /dt)
theta_dot_rad = np.radians(theta_dot_deg)

v = 5 # m/s
m = 100 # kg
I = np.array([[34, 1, 6], [1, 15, 3], [6, 3, 10]]) # Inertia matrix in kg*m^2
```

Convert 3-2-1 euler angle rates to omega

[10]:
```
A = np.array([[-np.sin(theta_rad[1]), 0, 1],
              [np.cos(theta_rad[1])*np.sin(theta_rad[2]), np.cos(theta_rad[2]),␣
↪0],
              [np.cos(theta_rad[1])*np.cos(theta_rad[2]), -np.
↪sin(theta_rad[2]), 0]])
omega = A @ theta_dot_rad
print("Angular velocity (rad/s):", omega)
```

```
Angular velocity (rad/s): [ 0.0728439   0.01832893 -0.01625115]
```

Calculate Kinetic Energy

[14]:
```
T = 0.5 * m * v**2 + 0.5 * omega.T @ I @ omega
print("Translational Kinetic Energy (J):", 0.5 * m * v**2)
print("Rotational Kinetic Energy (J):", 0.5 * omega.T @ I @ omega)
print("Total Kinetic Energy (J):", T)
```

```
Translational Kinetic Energy (J): 1250.0
Rotational Kinetic Energy (J): 0.08738487252409395
Total Kinetic Energy (J): 1250.0873848725241
```