

Question3

September 25, 2025

1 Question 3: Coupled dynamical and kinematic update

```
[2]: import numpy as np
      from solver import EulerAngleSolver, EulerRigidBodyDynamics
      from plotter import SimulationPlotter
```

Import Data:

```
[3]: # Principal inertias (kg m²)
      I1 = 210.0
      I2 = 200.0
      I3 = 118.0
      INERTIA_TENSOR = np.diag([I1, I2, I3])

      # Initial conditions
      INITIAL_EULER_ANGLES = np.array([0.0, 0.0, 0.0]) # Roll (), Pitch (), Yaw ()
      INITIAL_ANGULAR_VELOCITY = np.array([0.2, 0.15, 0.18]) # 1, 2, 3
      INITIAL_CONDITIONS = np.concatenate([INITIAL_EULER_ANGLES,
      ↪ INITIAL_ANGULAR_VELOCITY])

      dynamics_handler = EulerRigidBodyDynamics(INERTIA_TENSOR)
```

Solve simulation:

```
[4]: # Simulation Parameters
      T_INITIAL = 0.0
      T_FINAL = 30.0
      DT = 0.01

      solver = EulerAngleSolver(INITIAL_CONDITIONS, T_INITIAL, T_FINAL, DT,
      ↪ dynamics_handler)
      time_points, state_history = solver.solve()

      print("Simulation complete.")
```

Simulation complete.

```
[5]: # Plot the results
      SimulationPlotter.plot_full_state(time_points, state_history, DT)
```

