import numpy as np

import matplotlib.pyplot as plt

# === Constants ===

days = np.linspace(0, 365, 365 \* 4) # Daily resolution

longitude\_deg = 0 # Change this to simulate different locations

# === Frequencies ===

f\_mbt = 1 / 365.25 # MBT annual cycle

f\_moon = 1 / 27.3 # Moon orbit cycle

amp\_mbt = 1.0 # Arbitrary scaling

amp\_moon = 1.0

# Convert longitude to phase offset

longitude\_rad = np.radians(longitude\_deg)

# === Compute each component ===

mbt\_tide = amp\_mbt \* np.sin(2 \* np.pi \* f\_mbt \* days + longitude\_rad)

moon\_tide = amp\_moon \* np.sin(2 \* np.pi \* f\_moon \* days + longitude\_rad)

# === Combine ===

combined\_tide = mbt\_tide + moon\_tide

# === Plotting ===

fig, axs = plt.subplots(3, 1, figsize=(12, 8), sharex=True)

axs[0].plot(days, mbt\_tide, label="MBT Inertial Tide", color="blue")

axs[0].set\_ylabel("Displacement (m)")

axs[0].legend()

axs[0].grid(True)

axs[1].plot(days, moon\_tide, label="Moon Tide", color="green")

axs[1].set\_ylabel("Displacement (m)")

axs[1].legend()

axs[1].grid(True)

axs[2].plot(days, combined\_tide, label="Combined Tide", color="red")

axs[2].set\_ylabel("Displacement (m)")

axs[2].set\_xlabel("Day of Year")

axs[2].legend()

axs[2].grid(True)

fig.suptitle(f"MBT + Moon Tidal Simulation at Longitude {longitude\_deg}°")

plt.tight\_layout()

plt.show()