

# Lab3: Attitude Determination with the CubeSatSim

## Lab Objective

In this lab, you will explore the process of attitude determination using the CubeSatSim, a simulated CubeSat platform equipped with **Inertial Measurement Unit (IMU)** sensors. Attitude determination is a critical aspect of satellite operation, as it involves calculating and maintaining the orientation of the satellite in space. Through this lab, you will gain practical experience in using accelerometer and gyroscope data from IMU sensors to estimate the CubeSat's orientation.

## Lab instruction

### **Step1: Receive Radio from your satellite**

From the ground station, start to receive the signal from your satellite.

### **Step2: Rotate your satellite**

The data receiving frequency of the ground station is not much high as expected, so slowly change the orientation of the satellite.

### **Step2: Download CSV Data from the Ground Station**

As previously you did, click each component and save csv files into './CSV\_Files'. Keep naming conventions as 'x\_imu\_dps' and 'x\_imu\_acc', 'y\_imu\_dps', 'y\_imu\_acc', 'z\_imu\_dps', 'z\_imu\_acc'. This is not required to create your own python file.

The screenshot shows the AMSAT Telemetry Analysis Tool interface. The top bar indicates the satellite is 'CubeSatSim-FSK' and the mode is 'TRANSPONDER'. The status bar shows 'Telemetry Payloads Decoded: 274'. The main display area is divided into several panels:

- Radio:** RSSI (dBm) 0, TX Antenna Deployed, RX Antenna Stowed.
- Computer Hardware:** IHU Temp (Pi) (C) 35.2, I2C Bus 1 OK, I2C Bus 3 OK, Camera OK.
- Computer Software:** Spacecraft Spin (rpm) 0.0, Safe Mode OFF, Ground Commands 0, Simulated Telemetry ON.
- Battery:** Cell A+B+C Voltage (V) 4.1, Current (mA) -170.0.
- PSU:** Voltage (V) 5.0, Current (mA) 163.0.
- Experiments:** STEM Payload Status OK, BME280 Temp (C) 0.0, BME280 Pressure (hPa) 0.0, BME280 Altitude (m) 0.0, BME280 Humidity (%) 0.0, Diode Temp (C) 0.0, Sensor 2 (signed scal...) 0.0.
- +X Panel:** Voltage (V) 1.2, Current (mA) 0.0, Rotation (dps) 0, Acceleration (g) 0.0.
- +Y Panel:** Voltage (V) 1.0, Current (mA) 0.0, Rotation (dps) 0, Acceleration (g) 0.0.
- +Z Panel:** Voltage (V) 1.0, Current (mA) 0.0, Rotation (dps) 0, Acceleration (g) 0.0.
- X Panel:** Voltage (V) 0.9, Current (mA) 0.0.
- Y Panel:** Voltage (V) 4.4, Current (mA) 245.0.
- Z Panel:** Voltage (V) 0.9, Current (mA) 0.0.

The bottom status bar shows 'Current' selected, 'Last 180 samples Captured: 2021/10/16 21:02:55', and 'Payloads: 274'.

**Step3: Download or Copy Python Code** (If you are running the reference code)

[Link to Lab3 Code](#)

**Step4:** Let's check the Result

If you want to convert radian to degree, you can simply multiply  $180/\pi$ . Verify if the sensor worked!