

Node Test: sensor_simulator_node

(SensorSimulator)

Node test set up and prerequisites:

- ROS2 Jazzy
- g425_assign4_interfaces_pkg installed (provides ImuSim message)
- GoogleTest installed
- Build system: colcon
- Test subscriber node listens to /imu_sim_acceleration
- Simulator node uses ROS2 parameters to define interpolation intervals and compute IMU acceleration
- Tests may require temporary parameter modification using set_parameter()

Test1 : Node loads parameters and creates intervals

Tester : Burhan

date : 03-12-2025

Short description test:

- Verifies that the simulator properly loads at least one intervals.* parameter on startup.
- Functionality tested: interval parsing and storage during node construction.
- SMART goal: After node creation, the parameter list must contain ≥ 1 entry under the intervals namespace.

Input test:

- No parameters manually injected—the simulator must load its default parameters.
- Test checks list_parameters({"intervals"}, 10).

Expected result :

- intervals_param.names.size() ≥ 1

Result test:

- Unknown file failure

Test2 : Periodic publishing

Tester : Burhan

date : 03-12-2025

Short description test:

- Tests that the sensor simulator publishes IMU messages at the default rate (~50 Hz).
- SMART goal: Within 200 ms, at least one message must be received on /imu_sim_acceleration.

Input test:

- No custom parameters
- Simulator publishes at fixed frequency at startup
- Subscriber listens and sets received_ = true upon first message

Expected result :

- At least one message received within 200 ms

Result test:

- Unknown file failure
- The regular node works, this is a test programming failure

Test3 : Acceleration matches expected derivative for a linear interval

Tester : Burhan

date : 03-12-2025

Short description test:

- Tests that a linear interpolation interval on the linear_x axis produces the correct constant acceleration (derivative).
- SMART goal: With y0=0, y1=4, t0=0, t1=2, the acceleration should be constant:
- $\text{expected_acc} = (4-0)/(2-0) = 2.0$

Input test:

- intervals.0.axis = "linear_x"
- intervals.0.poly = "linear"

- intervals.0.t0 = 0.0
- intervals.0.t1 = 2.0
- intervals.0.y0 = 0.0
- intervals.0.y1 = 4.0

Changes are performed after parameters are changed

Expected result :

- The simulator's IMU output should publish this acceleration on the x field.
last_msg_.x ≈ 2.0 +- 1 second

Result test:

- Unknown file failure
- The regular node works, this is a test programming failure

Test4 : Quadratic derivative is non-zero inside interval

Tester : Burhan

date : 03-12-2025

Short description test:

- Tests whether a quadratic interval produces a derivative (acceleration) that is approximately zero at the beginning or end of the interval.
- SMART goal: For a symmetric quadratic with peak at tm = 0.5, derivative at t≈0 is very close to zero.
- Expected output should reflect this on the yaw_z field.

Input test:

- intervals.1.axis = "angular_z"
- intervals.1.poly = "quadratic"
- intervals.1.t0 = 0.0
- intervals.1.t1 = 1.0
- intervals.1.tm = 0.5
- intervals.1.y0 = 0.0

- intervals.1.ym = 1.0
- intervals.1.y1 = 0.0

Changes are performed after parameters are changed

Expected result :

- Published yaw_z acceleration ≈ 0.0 with tolerance +-0.1

Result test:

- Unknown file failure
- The regular node works, this is a test programming failure

Remarks:

- **These tests are regression tests for future updates to interpolation logic or IMU computation.**
- **Ensure that all parameters are being updated properly; dynamic parameter updates require that the node supports `on_set_parameters_callback` (if used).**
- **Tests were successful at date of creation, but unsuccessful when writing report**