Programming SBR Part - II
Balancing and Tuning

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Agenda for Discussion

1. Pre-processing Sensor Data
   - Noise in sensors
   - Plotting graph
2. Filtering Technique
   - High Pass and Low Pass Filters
   - Complementary Filter
3. Synchronization for SBR
   - Interrupt
   - Interrupt vs Polling
4. Balancing SBR
   - Algorithm
   - Integral windup

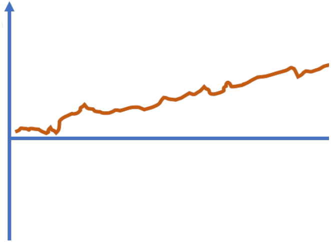
Outline

Noise

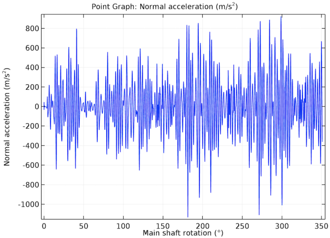
Low Frequency Noise: slow, persistent fluctuations or variations in the output signal. Eg: Bias instability or Angular Random Walk

High Frequency Noise: small, rapid fluctuations or variations in the output signal. Sources - mechanical vibration, temperature variation, quantization noise, etc..

Plotting Graph



(a) Raw Gyro value



(b) Raw Accel Value

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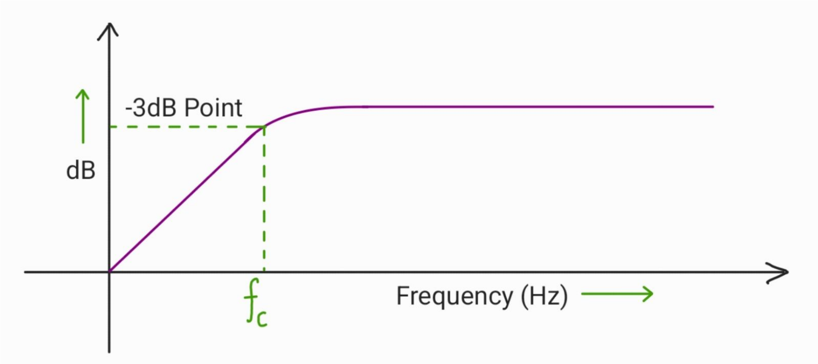
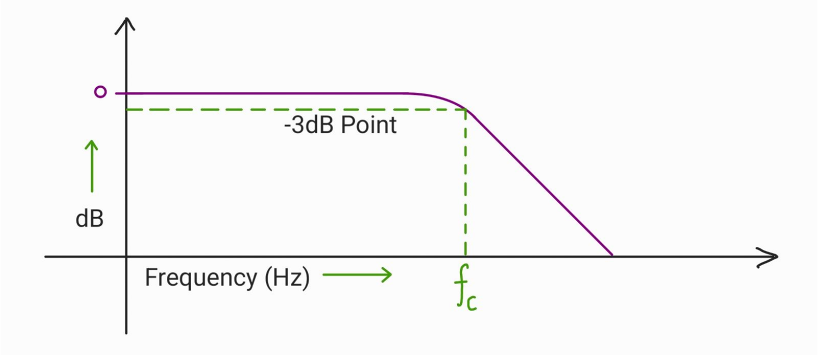
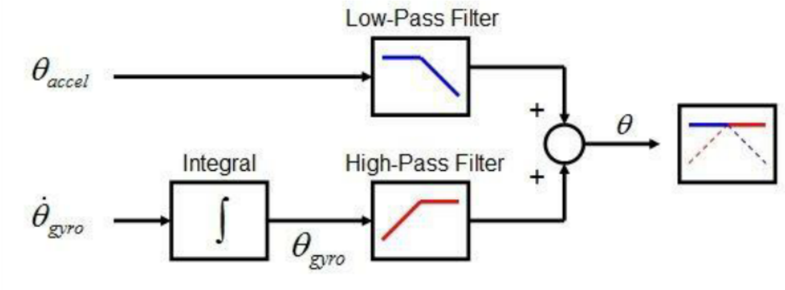
High Pass Filter



Low Pass Filter



Complementary Filter



$$\Theta_n = \alpha \cdot (\Theta_{n-1} + \text{gyroDot} \cdot dt) + (1 - \alpha) \cdot (\Theta_{\text{acc}})$$

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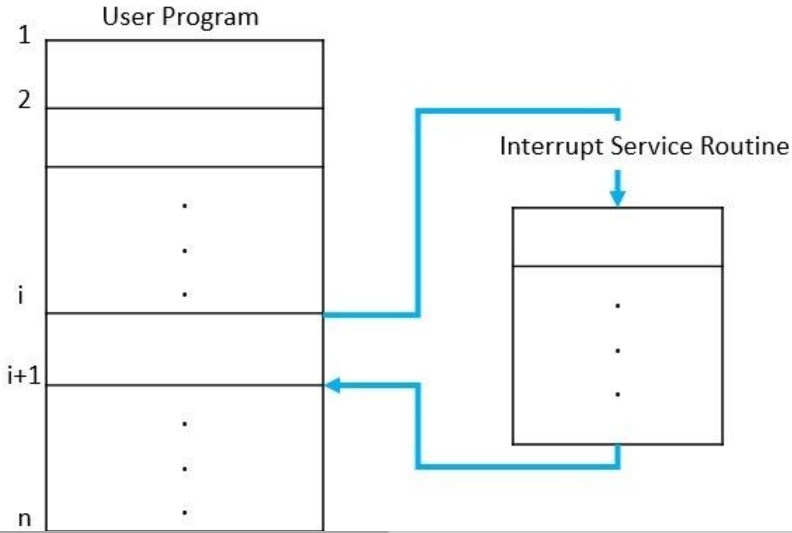
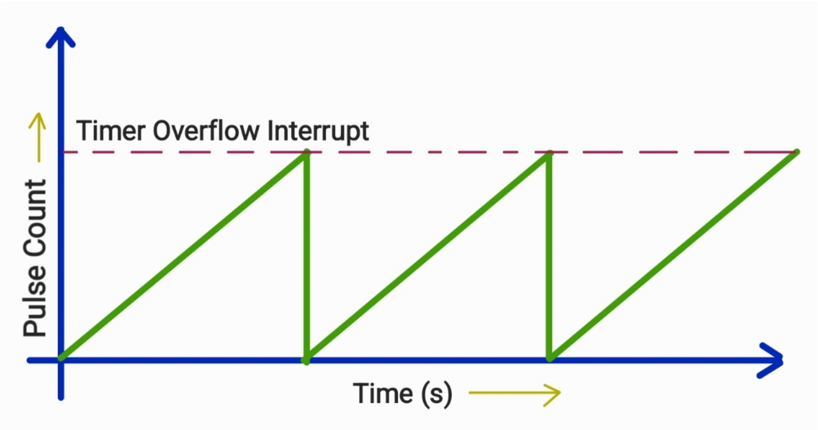
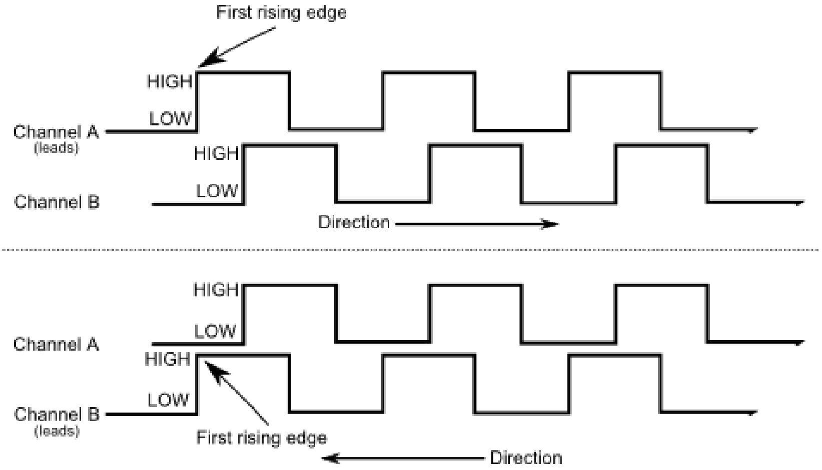
Interrupt



Timer Interrupt



Motor Encoder

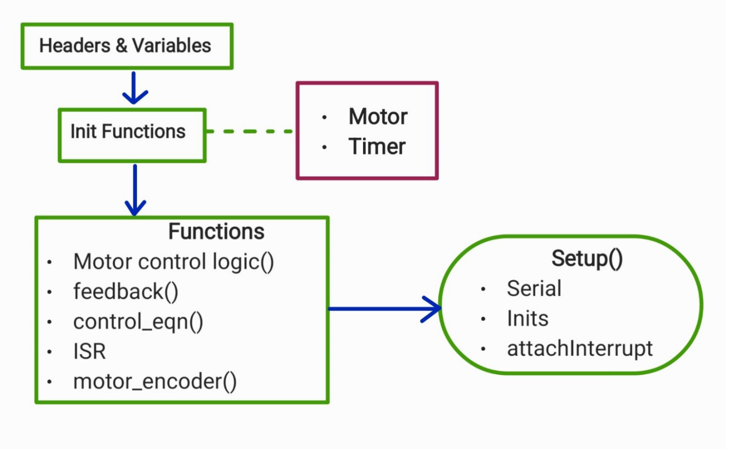


Interrupt vs Polling

- Triggering Mechanism
- Complexity to implement
- CPU Utilization
- Change in sampling time

Outline

Algorithm


Headers & Variables
Init Functions
Motor
Timer
Functions
Motor control logic()
feedback()
control_eqn()
ISR
motor_encoder()
Setup()
Serial
Inits
attachInterrupt

Integral Windup

Integral windup is a phenomenon that occurs in PID control systems when the integral component of the controller accumulates error beyond acceptable limits.

Its implications:

- Accumulation of Error due to constants
- Saturation or Constraint of output actuator/input
- Overshoot and Instability
- Delayed Recovery

Thank You!

Post your queries on: support@e-yantra.org
Contents available on: e-yantra Resources
For more details, please visit: e-yantra website