**POWER SPECTRUM IMPLEMENTATION**

* **Choosing a specific window**

Obtain specific segments of the accelerometer signals (x, y z)

window\_scg\_x=dataArrayPlux(30000:65000, 3);

* **Filtering**

Filter the windows using bpFilt, the filter that is the one configured for the accelerometer signals up in the code (band-pass filter from 1-14Hz, 4th order and the corresponding sample frequency).

scg\_x\_filtered = filtfilt(bpFilt, window\_scg\_x);

* **Module calculation**

Obtain the magnitude of the filtered signals (x, y z).

mod=sqrt(scg\_x\_filtered.^2 + scg\_y\_filtered.^2 + scg\_z\_filtered.^2);

* **Fast Fourier Transform**

Transform the filtered signals and the module to the frequency domain, best visualization of the frequency components of the signal.

fft\_scg\_x = fft(scg\_x\_filtered);

* **Unilateral Spectrum (Real Signal)**

Only compute the positive values of the FFT (floor(L/2)+1). Calculation of the magnitude of the FFT (abs) and normalize it by L, the length of the signal.

L = length(window\_scg\_x);

P1\_x = abs(fft\_scg\_x(1:floor(L/2)+1))/L;

* **Frequency vector associated with the spectral power**

This help to associate the power values back to their respective frequencies.

f\_one\_sided = Fs\*(0:(floor(L/2)))/L;

* **Only work with frequencies that are less 30 Hz**

Index that contains only frequencies that less or equal than 30 Hz (x axes in the graphic)

idx = f\_one\_sided <= 30;

* **Consider the band of 0.8-1.8 Hz, where the SCG/BCG signal should appear**

idx\_band = f\_one\_sided >= 0.8 & f\_one\_sided <= 1.8;

* **Total Spectral Power Calculation**

Calculated by summing the squares of the magnitudes of the FFT calculation, we get the total energy in the signal.

total\_power\_x = sum(P1\_x.^2);

* **Spectral Power in the Band [0.8-1.8 Hz] Calculation**

Summing up the power in just the band using the index that select this correct frequency range.

band\_power\_x = sum(P1\_x(idx\_band).^2);

* **Divide the Band Power with the Total Power (Ratios)**

This help as to visualize and quantify how much of the total spectrum power is concentrated in the band of interest. Show the values in the command window.

ratio\_x = band\_power\_x / total\_power\_x;

* **Plot the Power Spectrum in the frequency of interest (<30 Hz)**

The x axis is represented by f\_one\_sided(idx).

The y axis is represented by P1\_x(idx).

plot(f\_one\_sided(idx), P1\_x(idx));

**Escala de tiempo

Descripción generada automáticamente con confianza bajaEscala de tiempo

Descripción generada automáticamente con confianza baja**



**Imagen que contiene Escala de tiempo

Descripción generada automáticamente**



**Ratio Calculation Mobile Phone:**

Ratio X-axis: 0.47688

Ratio Y-axis: 0.19674

Ratio Z-axis: 0.22438

Ratio of the module: 0.055021

**Ratio Calculation Headphones:**

Ratio X-axis: 0.034749

Ratio Y-axis: 0.034394

Ratio Z-axis: 0.011299

Ratio of the module: 0.0060535

**Ratio Calculation BioPlux:**

Ratio X-axis: 0.092575

Ratio Y-axis: 0.22375

Ratio Z-axis: 0.11846

Ratio of the module: 0.019672