# Geometric Progression Filter

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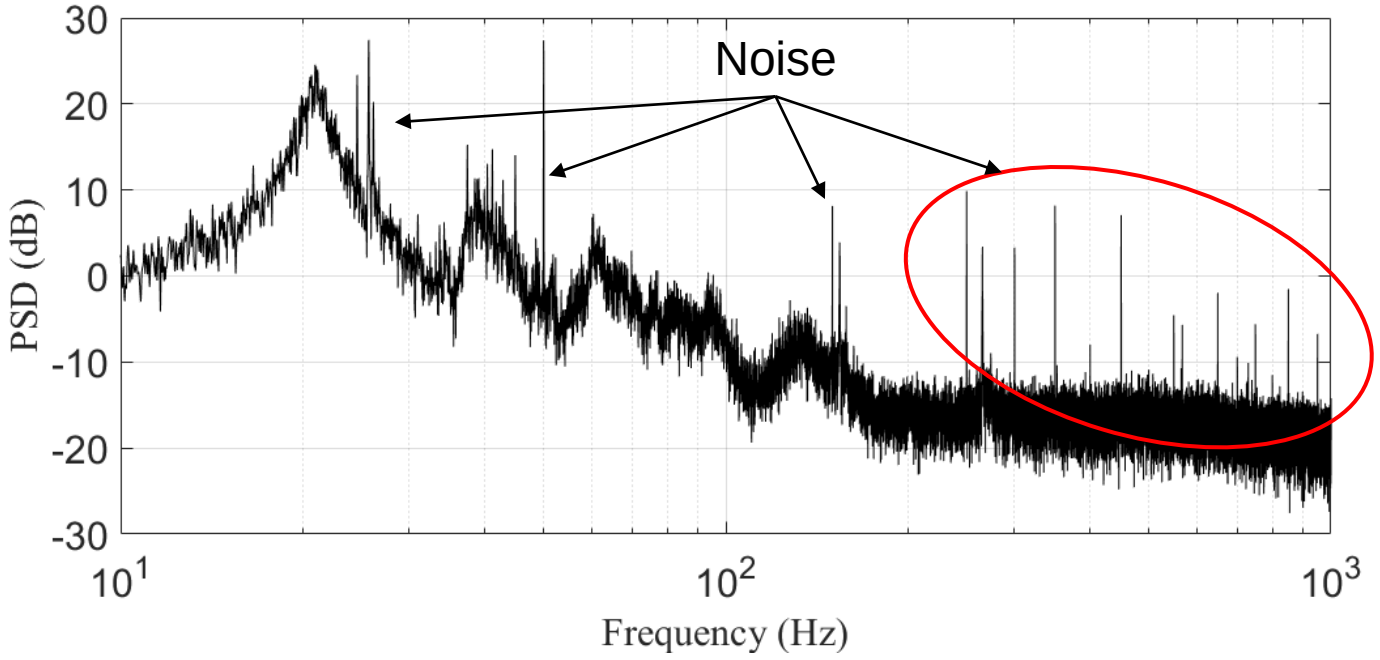
4th April 2022

# Context

Filter out specific frequencies coming from electronic interference.
Ex: Power grid (50Hz in France)




Experimental lift data from wind-tunnel

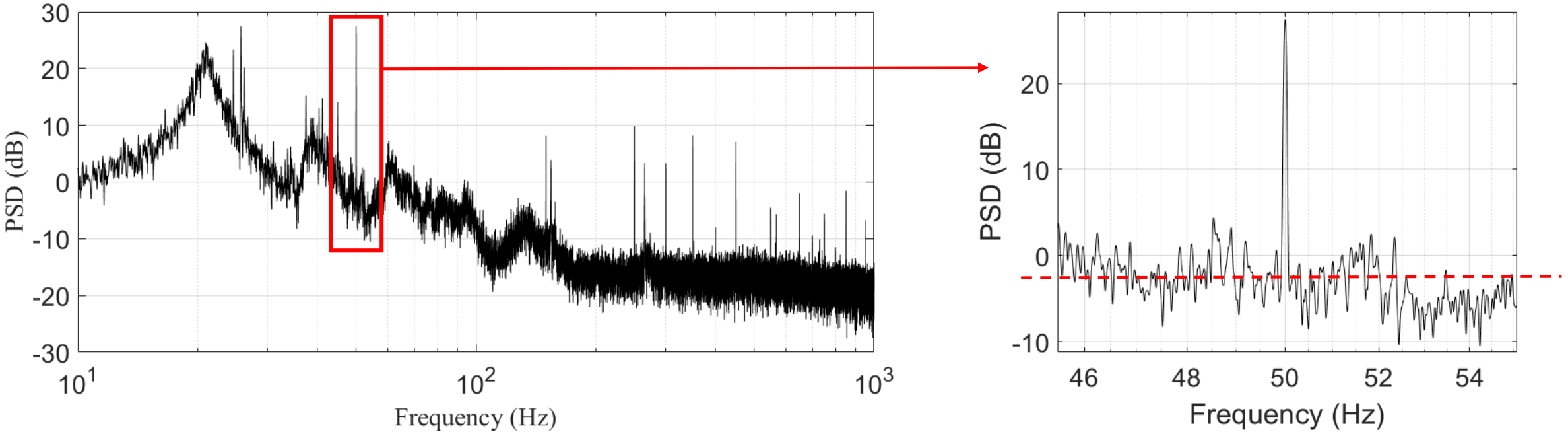
# Description

In order to eliminate only the peaks generated by electronic interference, a new approach was created

I. Compute the PSD
II. Split the signal into windows
    - Constant window size
    - GP approach
III. Apply median filter on each window

# Constant Window Size

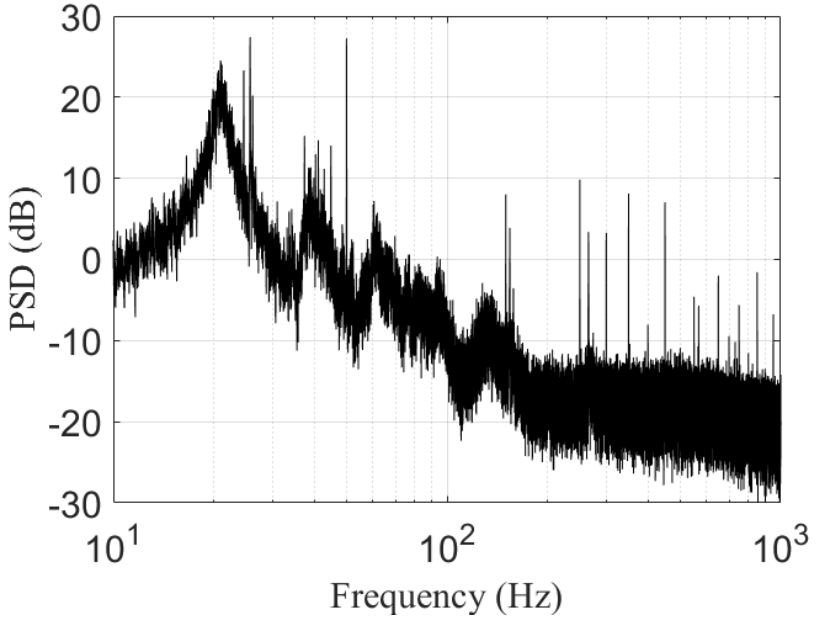
The signal is divided into segments of equal length ***l***




Values higher than the window median by a pre-established factor ***k*** are replaced by the median itself

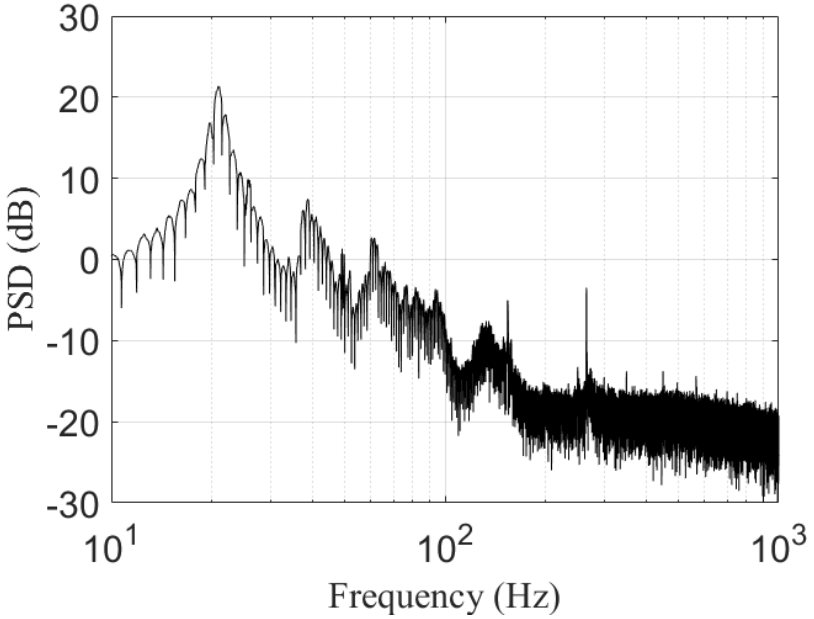
# Constant Window Size

**If window is to small**




**Not effective**

**If window is to large**




**Deformation of the spectrum**

For statistical reasons, the spectrum of a signal has less resolution in the low frequency region. The length of the windows must be adjusted.

# GP Approach

The window length ***l*** is set by a geometric progression rule

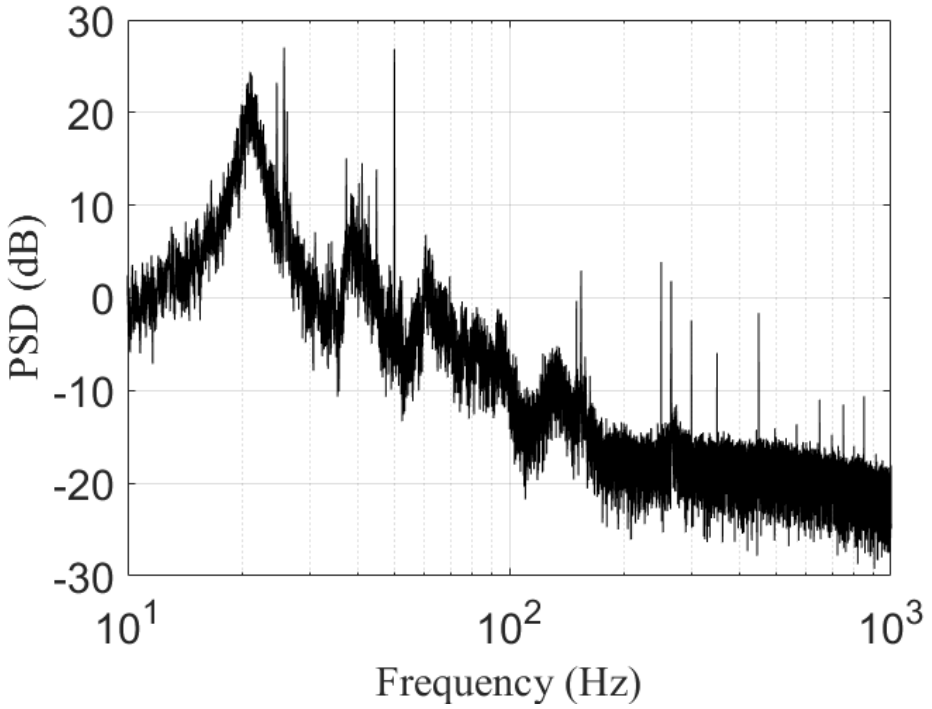
$$l_n = l_0 q^{n-1}$$ Where ***q*** is the ratio and ***n*** is the nth element

The threshold **τ** is defined as the product of the standard deviation of the window ***σ*** by a multiplication factor ***k***

$$\tau = k\sigma$$

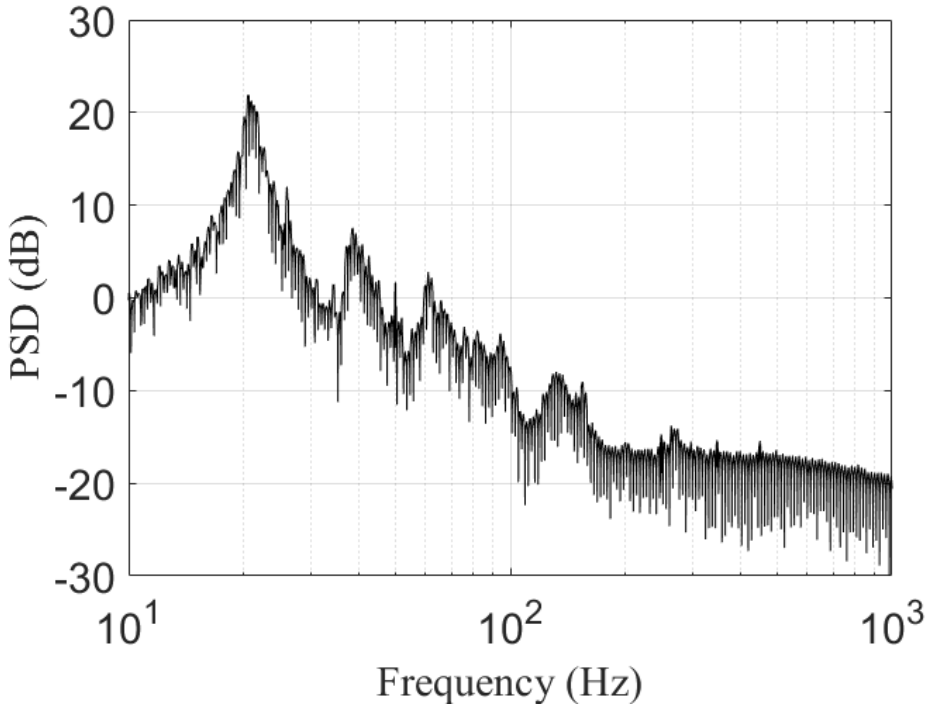
# GP Approach

**If q is to small**




**Not effective**

**If q is to large**



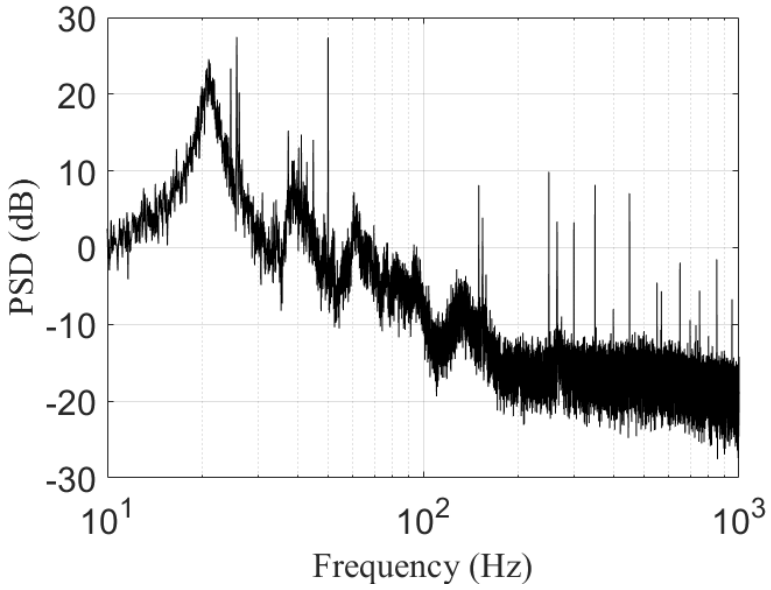

**Deformation of the spectrum**

$l_0$, $q$ and $k$ must be optimized

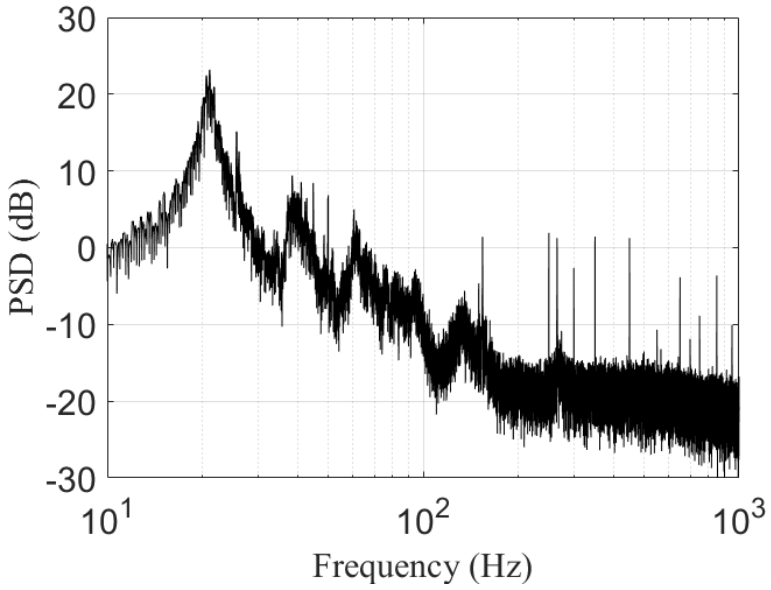
# Results comparison

By choosing optimal values for the parameters:

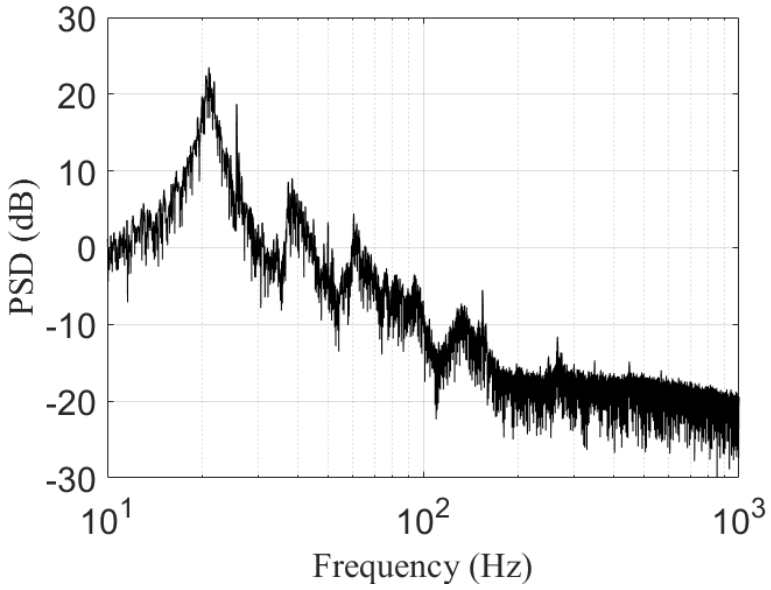
No filter




Linear filter




GP filter




For this kind of application the GP filter seems to be the most suitable.