Filtering of ECG and other electrophysiological signals

Contact: info@alango.com

1. Power line interference canceling

This technology effectively cancels 50/60Hz power line interference from ECG and other electrophysiological signals. This technology utilizes Alango proprietary, patent pending algorithm for Harmonic Noise Filtering (HNF). Unlike a notch filter, HNF removes not only the main interference frequency but all of its harmonics as well. HNF technology does not distort the waveform shape. It works similar to adaptive filtering by predicting and subtracting the interference from the recorded noisy signal producing a clean signal that exactly reproduces the signal of interest. However, unlike the classic adaptive filtering, HNF technology does not require a reference signal significantly simplifying both the recording hardware and software.

Technical information

- The algorithm operates in real time with no delay;
- Learning time (time necessary to estimate exact interference frequency and parameters of its harmonics) is less than half a second;
- Computational complexity is less than for the corresponding adaptive filter;
- No artifacts or ringing on pacemaker impulses;
- No reference signal required;
- Efficient fixed or floating point implementation.

Example of intracardiac ECG cleaning

Figure 1 shows an example of HNF application to filtering a very strong 50Hz interference with multiple harmonics from an intracardiac ECG signal. The signal was recorded by a catheter contacting and internal heart wall. The upper plot shows the original (green) and cleaned (red) signals. The bottom two plots shows spectrograms of the original and cleaned signals. It is seen that horizontal lines representing the interference harmonics are almost totally removed on the cleaned signal while the spectral content of interest is preserved.

2. Base Line Wander Filter of ECG signals

Alango base line ECG filtering removes very low frequency components from ECG recordings. Signal components with frequencies below 0.5Hz are filtered out while frequencies above are completely preserved in both amplitude and phase. These features are very important for complete preservation of the waveform of electrophysiological signals for their correct interpretation.

Technical information

- Algorithm delay is less than 0.5 sec;
- Computational complexity is about 10 operations per input sample;
- Efficient fixed or floating point implementation.

Example of base line wander filtering of ECG signal

Figure 2 shows an example of body-surface ECG signal. A strong base line wander caused by respiratory chest movement was removed without any distortion of the ECG signals.

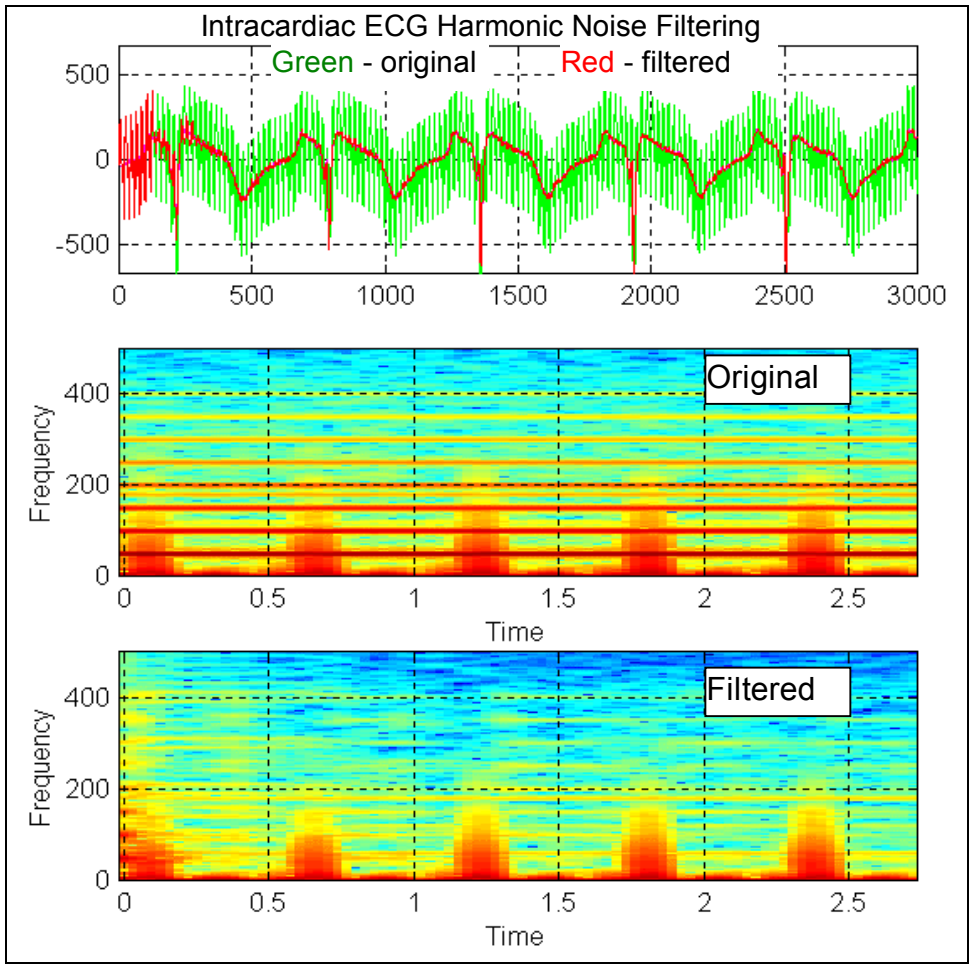

Figure 1. Intracardiac ECG power line interference filter

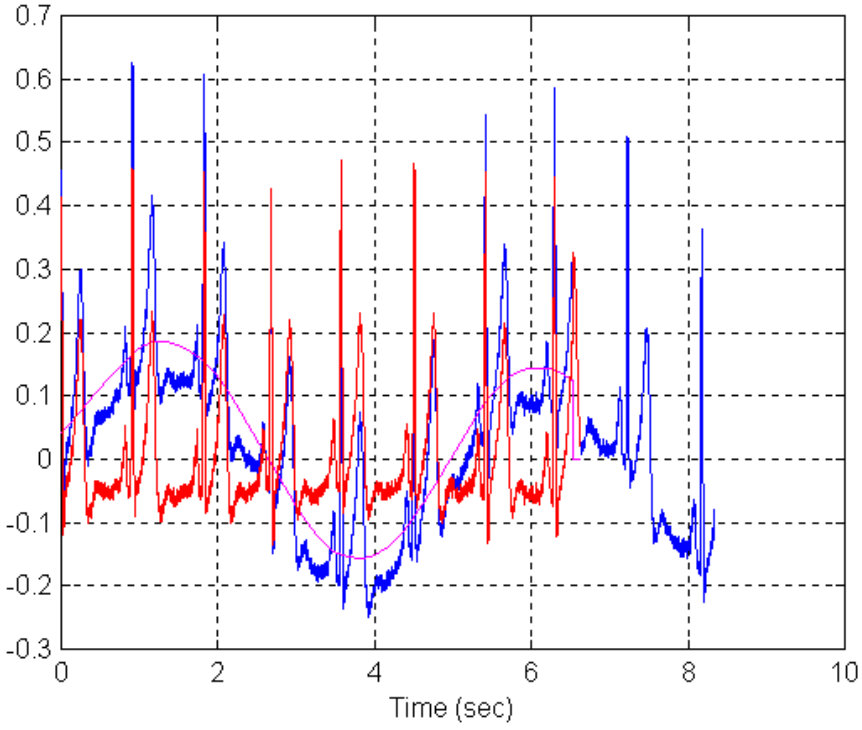

Figure 2. baseline wander filtering. Blue: original, Magenta: estimated baseline, Red: filtered