

Integrate EMG

Linear Envelope

Computing the EMG Envelope using rectify and lowpass filter

This section will compute the EMG Envelope using rectify and lowpass filter. Rectify takes the absolute value of every element of a signal. Visual3D calculates signal rectification using the following formula:
 $x(t_i) = \text{abs}(x(t_i))$

Lowpass Filter Cutoff

The default lowpass filter in Visual3D is a fourth order butterworth filter.

Butterworth filters have an upper limit on the magnitude of the cutoff frequency.

The maximum theoretical cutoff frequency is $(\text{sampling_rate} * 0.802 / 2)$.

Visual3D is a little more conservative than that because we have found the filter to be unreliable at the theoretical limits.

The highest cutoff frequency that Visual3D will allow you is $0.393 * \text{sampling-rate}$.

If your EMG signals are sampled at 1000 Hz, the highest cutoff frequency is 393 Hz.

Example Script

The highpass filter is not part of the linear envelope, but is used to remove the [DC offset](#).

```
! Apply high pass filter with 50 hz cutoff
Highpass_Filter
/Signal_Types=ANALOG
/Signal_Names=EMG1+EMG2+EMG3
/Signal_Folder=ORIGINAL
! /Result_Suffix=
/Result_Folder=HIGHPASS
! /Filter_Class=BUTTERWORTH
/Frequency_Cutoff=50
/Num_Reflected= 0
/Total_Buffer_Size=100
/Num_Bidirectional_Passes=1
;

! Rectify the signals
Rectify
```

```
/SIGNAL_TYPES=ANALOG
/SIGNAL_NAMES=EMG1+EMG2+EMG3
/SIGNAL_FOLDER=HIGHPASS
! /RESULT_NAMES=
! /RESULT_TYPES=
/RESULT_FOLDER=RECTIFY
! /RESULT_SUFFIX=
;

! Apply a low pass filter
Lowpass_Filter
/Signal_Types= ANALOG
/Signal_Names= EMG1+EMG2+EMG3
/Signal_Folder= RECTIFY
! /Result_Suffix=
/Result_Folder=LOWPASS
/Frequency_Cutoff=10
/Num_Reflected=50
;
```

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