

The sensitivity of FAS from high-cut filtered data to zero pads

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In *dependence_of_fourier_amplitude_spectra_at_low_frequencies_on_zero_pads_v02.pdf* I discuss the sensitivity of the Fourier spectra (FAS) from low-cut (high-pass) filtered data to zero pads (both for acausal and causal filters). Without zero pads, the FAS will have a floor at low frequencies that is considerably above that when pads are used (these pads are required to capture the very small transient response of the filter function). The same need exists for high-cut (low-pass) filtered data.

Here is a record originally sampled at 125 sps. As part of a separate study, I high-cut filtered the data, using a frequency-domain, acausal filter with a filter function given by the square of a raised cosine, with unit response at 16 Hz and zero response at 20 Hz (this was to mimic an anti-aliasing filter for 40 sps data; the equation giving the filter response is in the legend to Figure 2). Figure 1 shows the padded and filtered accelerations, with the bottom graph using a greatly expanded ordinate (enlarged by a factor of 2.4 million) in order to see details of the filter transient. The original time series was the portion between the vertical red lines.

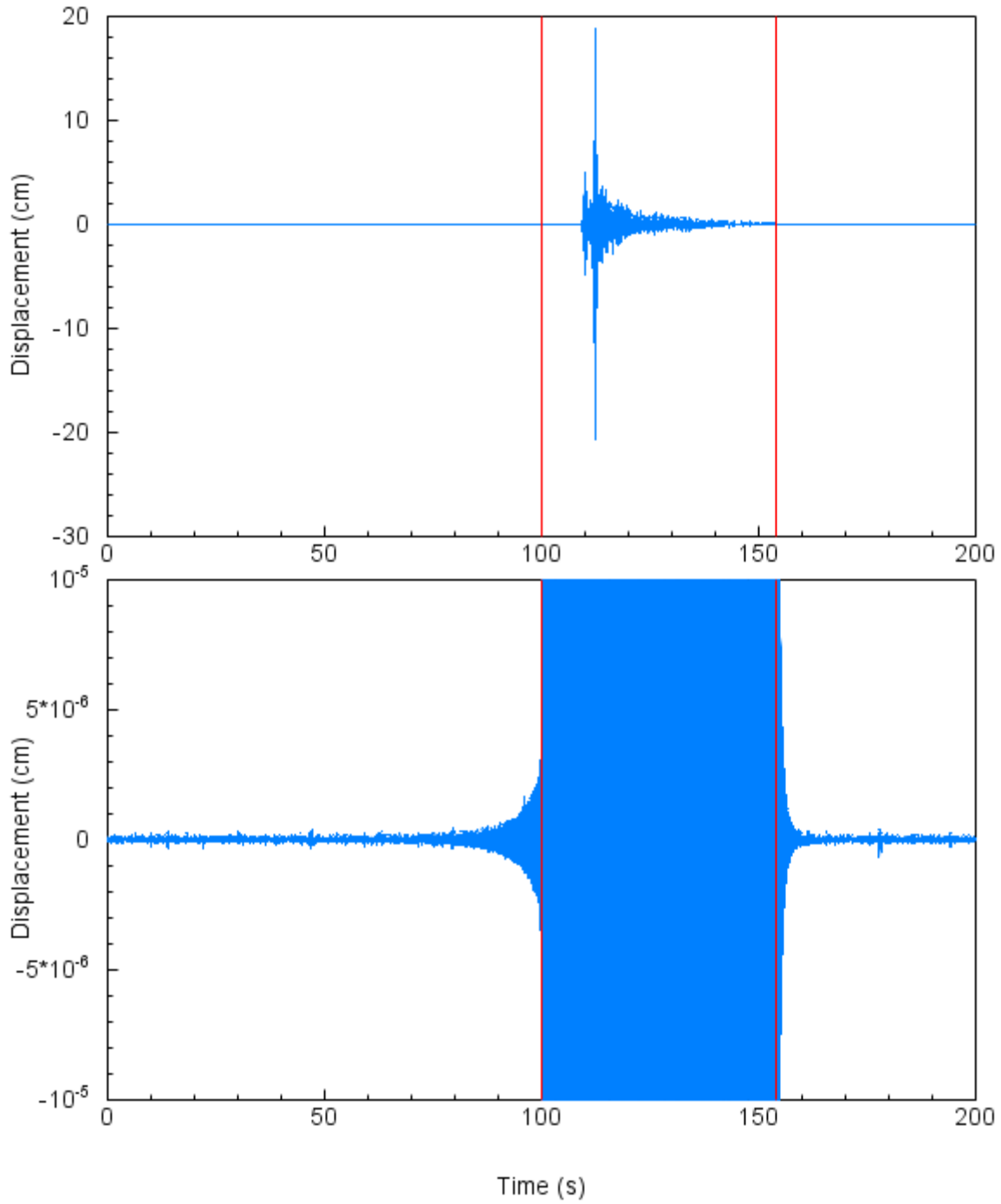
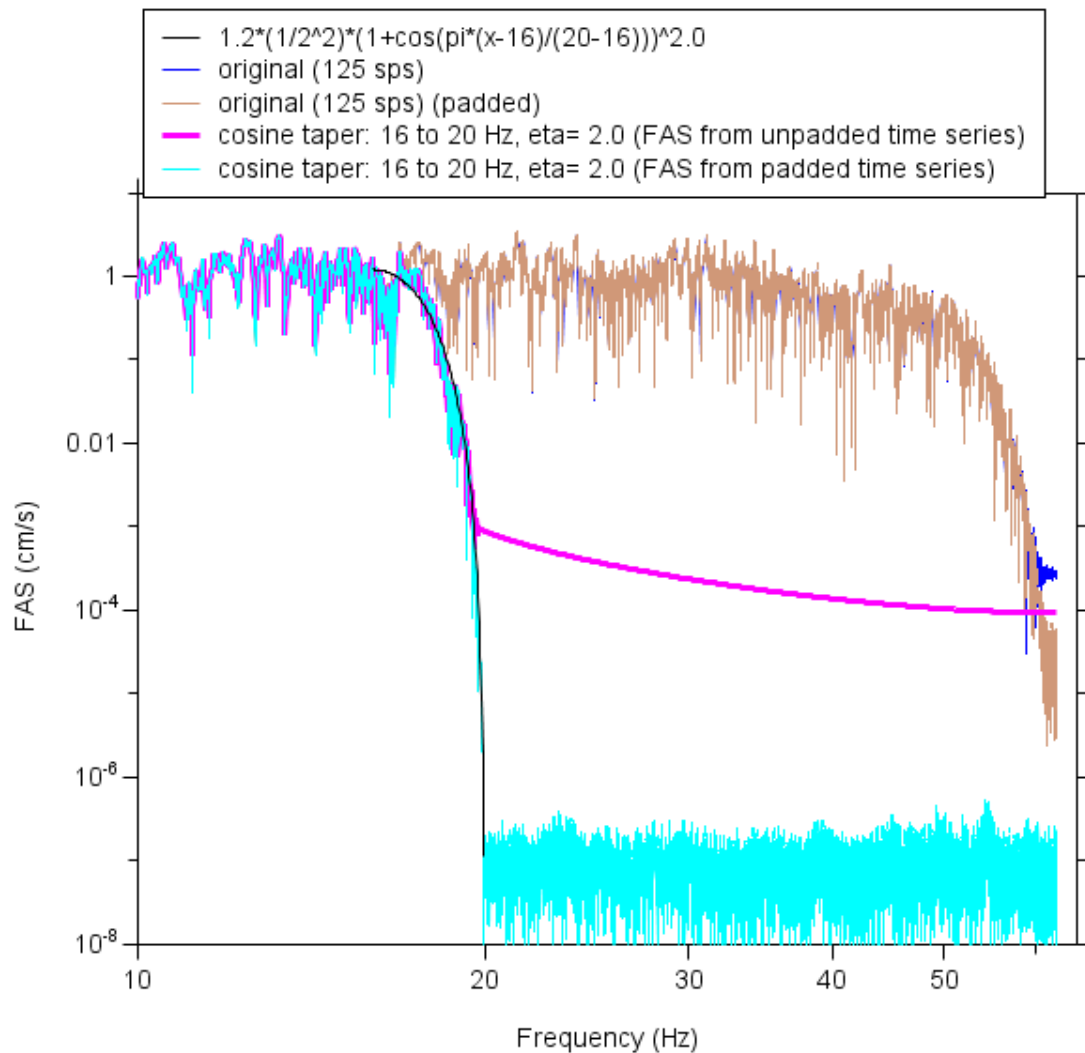


Figure 1.

The FAS for the unfiltered, padded and unfiltered, filtered, and padded and filtered time series are shown in Figure 2.



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Figure 2.

It is clear that including the very small filter transients in the padded and filtered time series results in a FAS with a much lower level at frequencies above the Nyquist frequency.

The good news is that the response spectra for this case are not sensitive to including the pads, as shown in Figure 3 (shown are the individual spectra and the ratio of response spectra from the unpadded and padded time series).

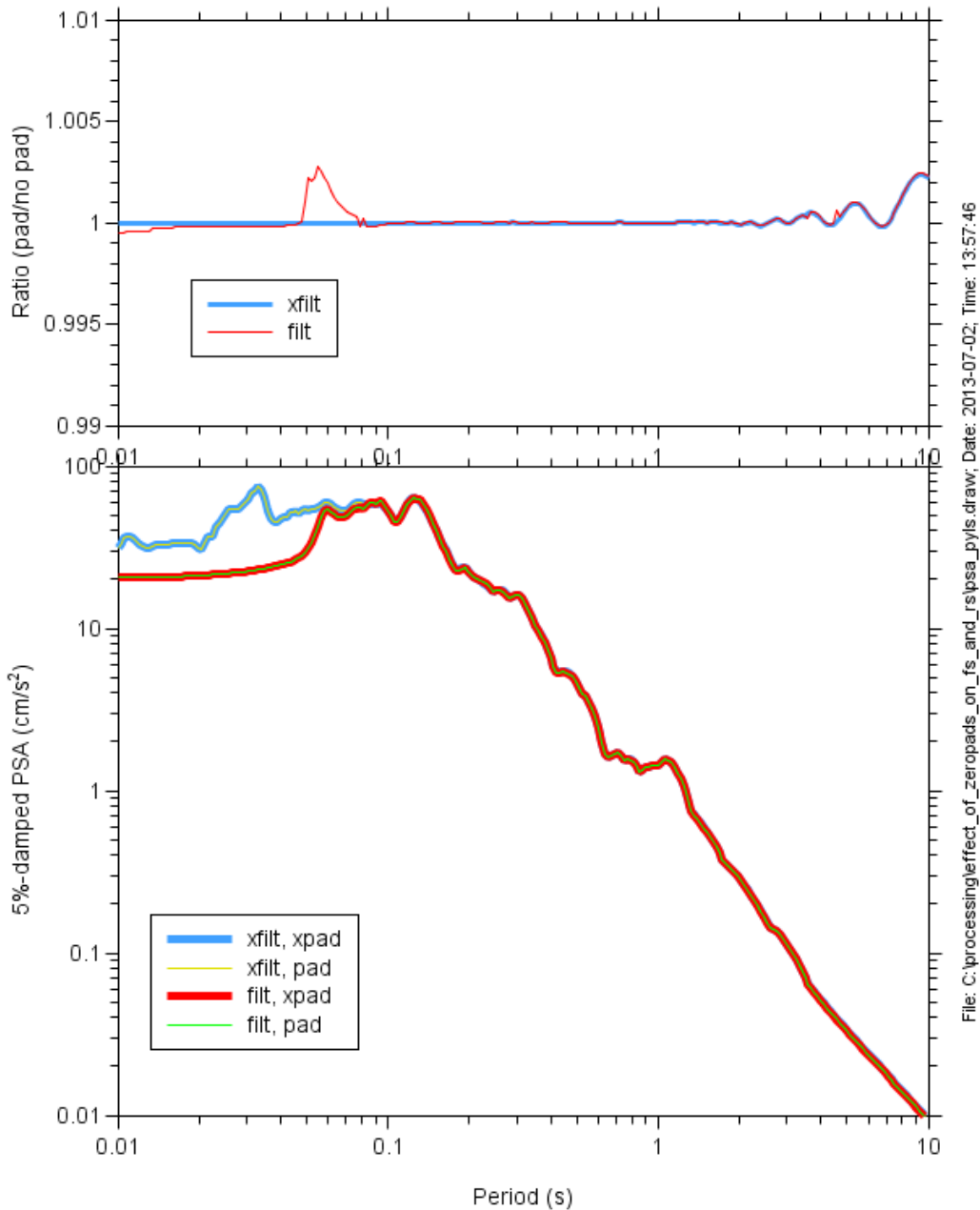


Figure 3.