

Dave Boore's notes on checking the shape of the FAS produced from a spike seismogram filtered using blpadflt.

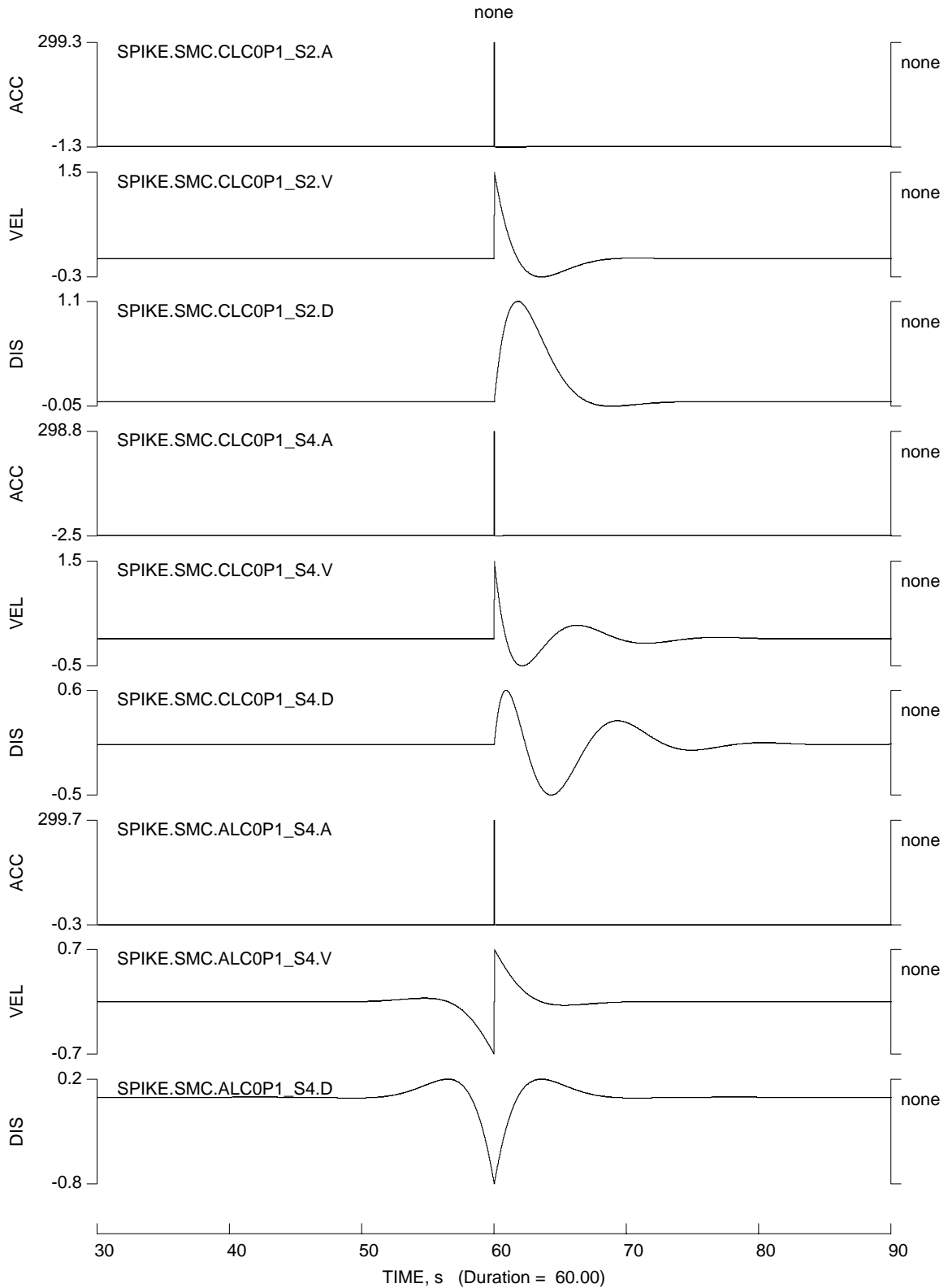
file: c:\filter\notes_on_checking_shape_of_fas_for_locut.doc

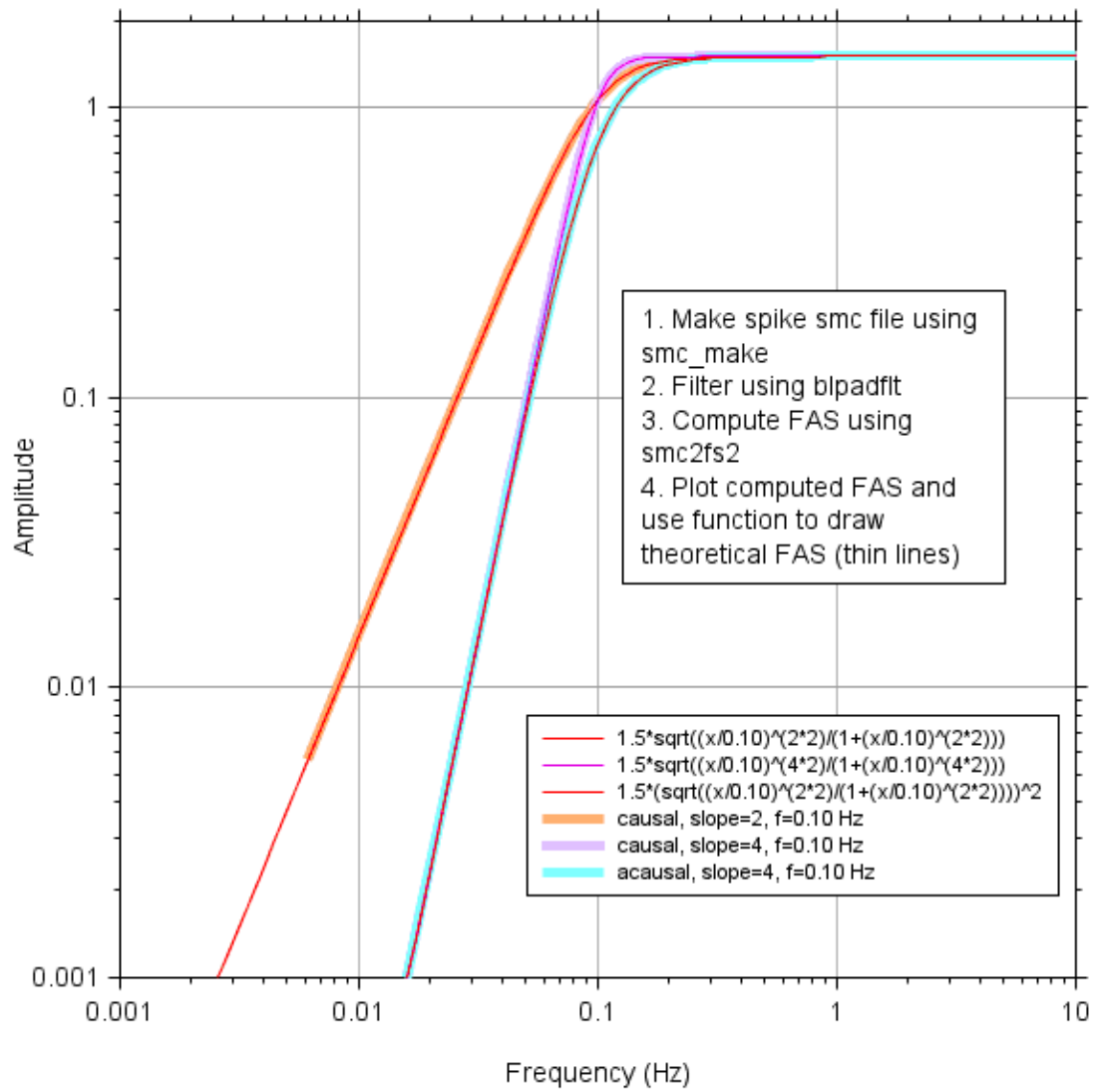
date: 10 January 2006

BLPADFLT uses Joyner's locut subroutine. I had put comment into the subroutine to relate the slope parameter *nroll* to the shape of the filter response, and I recently revised blpadflt to specify the asymptotic slope rather than *nroll* (which has a confusing relation to the response shape, being different for causal and acausal filter, for the same value of *nroll*). Recently it was brought to my attention that the GEOS instruments have a single-pole low-cut causal filter with 0.1 Hz corner. It seems that Joyner's locut subroutine will not allow a single-pole causal filter, but I wanted to check this in case I did not understand the relation of *nroll* to the filter shape: the lowest value of *nroll* equals 1, which according to my comments should give a response decreasing as $(f/f_c)^2$ for a causal filter (in other words, a 2-pole filter is the lowest allowed) and $(f/f_c)^4$ for an acausal filter. I checked this empirically, using my programs smc_make, blpadflt, and smc2fs2. I used $f_c = 0.1$ Hz and specified slopes of 2 and 4 for the causal filter and 4 for the acausal filter. The first figure below shows the time series, and the second compares the computed and theoretical filter functions. The comparison shows that my understanding and comments are correct. Here is the relevant code fragment from blpadflt:

* Force power of two and four for causal and acausal filters, respectively:

```
if (icaus .eq. 0) then ! acausal
  if (nslope_lc .lt. 4) nslope_lc = 4
  if (nslope_hc .lt. 4) nslope_hc = 4
  nslope_lc = 4 * int(float(nslope_lc)/4.0)
  nslope_hc = 4 * int(float(nslope_hc)/4.0)
  nroll_lc = nslope_lc/4
  nroll_hc = nslope_hc/4
else ! causal
  if (nslope_lc .lt. 2) nslope_lc = 2
  if (nslope_hc .lt. 2) nslope_hc = 2
  nslope_lc = 2 * int(float(nslope_lc)/2.0)
  nslope_hc = 2 * int(float(nslope_hc)/2.0)
  nroll_lc = nslope_lc/2
  nroll_hc = nslope_hc/2
end if
```





File: C:\filter\check_filt_shape_spike_alc0p1_cic0p1_fas.draw, Date: 2006-01-10