Creating a set of FFT simulation filters

If you have ?GMT (generic mapping tool) installed on your system you may use the tool *$SH_UTIL/prep_simfilters.csh* for creating a set of FFT simulation filters for your recording equipment.

Before starting the tool program you need to create a filter file describing your recording system in poles and zeroes. You should find this information in the manual of your seismometer. Give a name **<recsys>** to your system and create the file *$SH_FILTER/TF_VEL_S+<recsys>.FLF*. The format of the filter files is described here. Examples you find in *$SH_FILTER*, e.g. *TF_VEL_S+GRSN.FLF* or *TF_VEL_S+CMG40T.FLF*.

Please normalise your transfer function to 1.0 at the reference frequency (usually 1 Hz for broadband and most short period instruments). Please note that this is a transfer function for velocity input. The displacement transfer function should go into **TF_DSP_S+<recsys>**, which has just one more zero at 0.0. It is recommended to create a new temporary directory for running *prep_simfilters.csh*, because it will create a new GMT defaults file in it which can make you very unhappy if done in the home directory. cd to this new directory and enter

```
$SH_UTIL/prep_simfilters.csh <recsys>
```

It will read your *TF_VEL_S+<recsys>.FLF* file and create the simulation filters by dividing *TF_VEL_S+<simfil>.FLF* by *TF_VEL_S+<recsys>.FLF*.

The amplitude spectrum of the resulting file *<recsys>_S+<simfil>.FLF* will be displayed on screen using GMT and a PostScript? viewer. The plot will contain three graphs in different colours. The recording instrument *TF_VEL_S+<recsys>.FLF* is shown in red, the simulated instrument *TF_VEL_S+<simfil>.FLF* in blue and the resulting simulation filter *<recsys>_S+<simfil>.FLF* in green.

Check the behaviour of the green function at both ends, high and low frequencies. It should be constant or go to zero. An increasing filter function for high or low frequencies is instable and cannot be used, it would produce weird seismograms or could even crash SHM. If the instability of the filter is far outside of the range of interesting frequencies, the filter can be cured by applying an additional highpass, lowpass or bandpass filter.

If a substantial part of the simulation filter cannot be described the simulation filter should be deleted. After creating and showing the new simulation filter the programs offers a number of possible commands:

```
hp: apply an additional highpass filter to the simulation to cut off an instability at low frequenci
lp: apply an additional lowpass filter to the simulation to cut off an instability at high frequenci
bp: apply an additional bandpass filter to the simulation to cut off instabilities at high and low f
a: accept the simulation filter as it is now and proceed to the next filter
d: the simulation filter cannot be used, delete it and proceed to the next filter
```

The corner frequencies of possibly applied filters are prompted after entering hp, lp or bp. Please note that highpass filters take the corner period in s, lowpass and bandpass filters take the corner frequencies in Hz. Close the PostScript display window before entering the command, otherwise the windows will fill up your screen. After looping all necessary filters the program exits.

The resulting filter files can be found in the current directory. They should be moved to *$SH_FILTER* before starting SHM.

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