T4: Spectral Estimation with data from Great Earthquakes

For all programs to work properly, you need to download and execute them from the directory you created last time (the one in which the `data` directory is located).

Exercise 1 (*Display the Eigenmodes of an 24h Seismogram*)

a) Download eigenmodes.py and eiglst from the webpage to the working directory of last time

b) Open a cmd window, change to your working directory of last time and start IPython by `ipython -pylab`

c) Run `run -i eigenmodes.py` from your working directory of last time

d) Modify the number of zeros which are padded for the FFT

e) Explain the effect

Exercise 2 (*Study Effect of a Taper on a simple Sinus Signal*)

a) Download tapering.py and run it (`run -i tapering.py`)

b) Change the number of points (`npts`). Explain the effect.

c) Change the sampling frequency (`df`). Explain the effect.

d) Change the windowing function (`win_fct`). Find the effect on the signal.

Exercise 3 (*Study Taper Effect on an Earthquake*)

a) Download dominantfrequency.py and run it (`run -i dominantfrequency.py`)

b) Change the percent of the cosine taper and see what happens?

c) What are the two peaks in the spectra?

d) Zoom into the data (`tr.trim`) and do the same again.

e) Which peak is now prominent?

Exercise 4 (*Short Term Fourier Transformation*)

a) Download stft.py and run it (`run -i stft.py`)

b) Explain what you see, why are the frequencies changing in that way.

c) Why are the pixels in the STFT getting larger for higher periods?

d) What is the advantage of the STFT over the FFT? Could you use the STFT to plot the eigenmodes of the earth?

e) Replace the earthquake by noise (`commented lines`). What are the dominant frequencies here, where do they come from.

f) Look at other data from the data directory. Zoom to the correct part — **too long windows need a lot of processing time**.