Fourier and Wavelet Analysis: FFT

Matematik CTH

lp I 1999

Create a discretized sine function of length 1024. (Why 1024?)

Let the same function run on for a few samples, and pad with zeroes to length 2048.

Compute the Fourier transforms in MATLAB of both signals, plot the power spectrum in a conventional log-log diagram in a scale which allows a direct comparison in frequency content. (You have to make a suitable choice of the frequency of the sine signal to make the effect clear.) **When satisfied, print these power spectra, and hand in.**

Try filtering the padded signal to make the spectrum resemble more that of the pure sine. **When satisfied, print the result, and hand it in together with a description of the filtering.** (You need not construct your own filters from scratch: there is a SIGNAL PROCESSING TOOLBOX. Use the command `help signal` .)

To warm up, you could analyze some signals with the commands `fft` and `plot` in MATLAB, and the commands `spectrum` and `specplot` in the SIGNAL PROCESSING TOOLBOX:

1. $\sin 100t + 0.5 \sin 200t,\ t = 2\pi k/1024,\ k = 1, 2, ..., 1024$

   See the spikes in the power spectrum!

2. $\sin 100.5t + 0.5 \sin 200t,\ t = 2\pi k/1024,\ k = 1, 2, ..., 1024$

   Compare the result with the previous one!

3. $(2 + \sin 8t) \sin 100t$ (amplitude modulation)

   See both negative frequencies and the (still in our time disputed) side bands! (Some practitioners refuse to believe they - the side bands - exist. However, receiving a single side band convinces a majority.)

4. $\sin(100(1 + 0.1 \sin 8t)t)$ (frequency modulation)