

Example 8-14: Two Trumpets Signal, Revisited.

Purpose:

We are given the signal of two actual trumpets playing simultaneously notes A and B. The goal is to use the DFT to eliminate the trumpet playing note A, while preserving the trumpet playing note B. We need only know that note B is at a higher frequency than note A.

Inputs:

Signal of two actual trumpets playing notes A and B from the file `twotrumpetsAB.mat`.

`fr`=fundamental in Hz of note to reject.

`fs`=sampling rate in sample/s.

Outputs:

Plot and sound of two-trumpets signal.

Plot and sound of filtered two-trumpets.

Spectrum of two-trumpets signal.

Spectrum of two trumpets after filtering.

Comments:

- The first sound is the two trumpets.
Hit any key to hear the filtered signal.
- All we do is set harmonics of the *lower* fundamental frequency to zero, since we wish to eliminate the lower note, which is A.
- To preserve conjugate symmetry of the spectrum, we also set high indices to zero.

Program:

```
clear;load 'twotrumpetsAB.mat'  
fs=44100;fr=436;%reject note A  
L=length(X);FX=fft(X)/L;FY=FX;  
NF=round(fr*L/fs);%fundamental index  
%K=indices where spectra set to 0:  
K=[];for N=1:9;  
K=[K ([-30:30]+N*NF)];end  
K=[K L+2-K];%append conjugate indices  
FY(K)=0;%set harmonics of f to 0.  
Y=L*real(ifft(FY));  
%Plot time waveforms and spectra:  
I=[1000:1199];t=I/fs;%display
```

```
subplot(211),plot(t,X(I))  
subplot(212),plot(t,Y(I))  
F=[1:5000];f=(F-1)*fs/L;figure  
subplot(211),plot(f,abs(FX(F)))  
subplot(212),plot(f,abs(FY(F)))  
soundsc(X,fs),pause,soundsc(Y,fs)
```

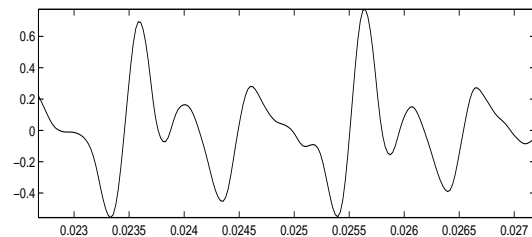
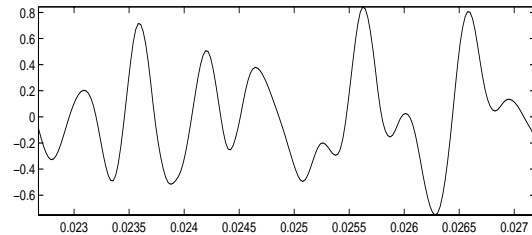


Figure 1: Two-trumpets (top) and filtered two-trumpets (bottom) waveforms.

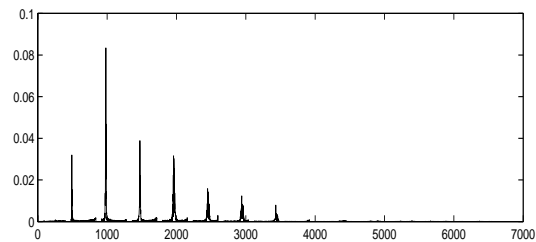
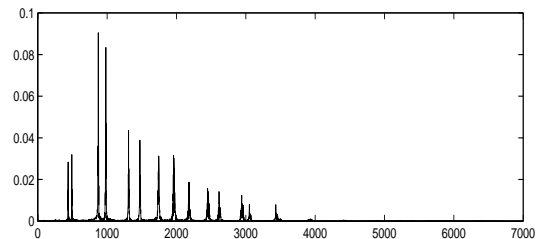


Figure 2: Two-trumpets (top) and filtered two-trumpets (bottom) spectra.