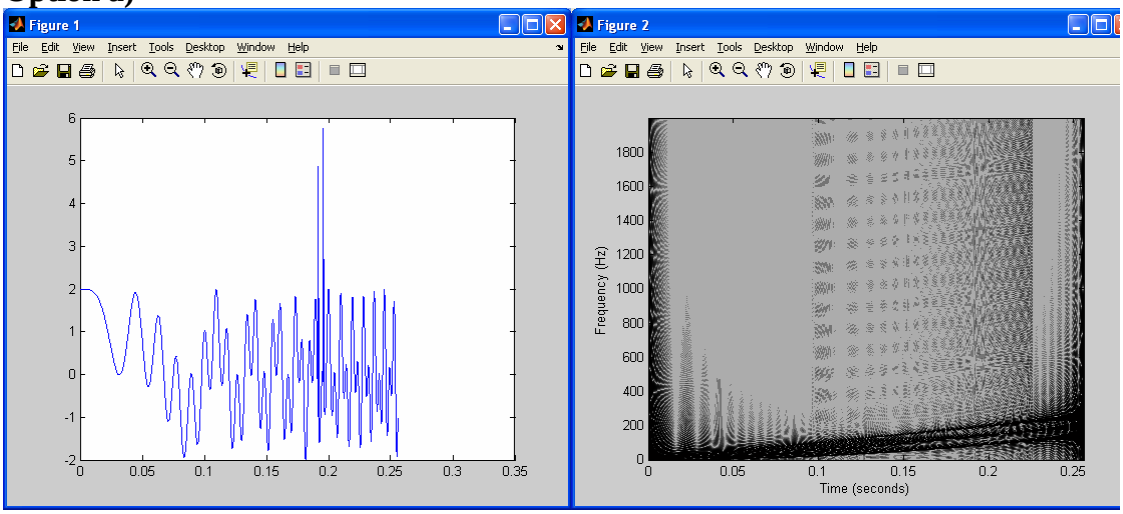
Physics 640
November 6, 2007

Project 5
**Week 6 & 7: Time-Frequency Analysis**
Project 5:

a) Develop a Matlab code that allows you to recognize a vowel from a recording (wav file) using the Wigner transform.
b) Write a Matlab code to demonstrate the advantage of using wavelet transform versus Fourier transform in signal recovery

Matlab code to calculate the Wigner function; and wavelet subroutines will be available

**Option a)**

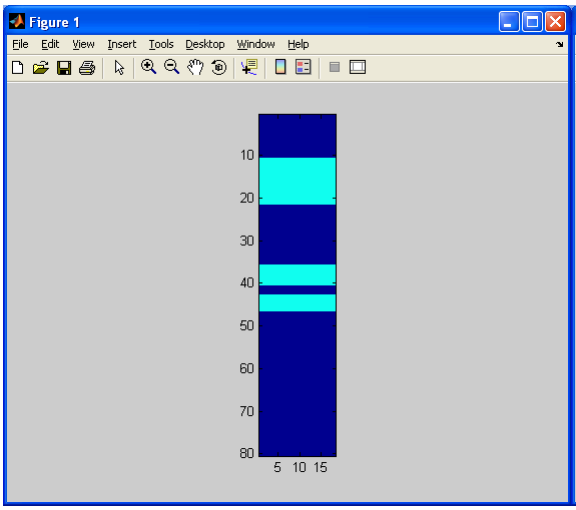


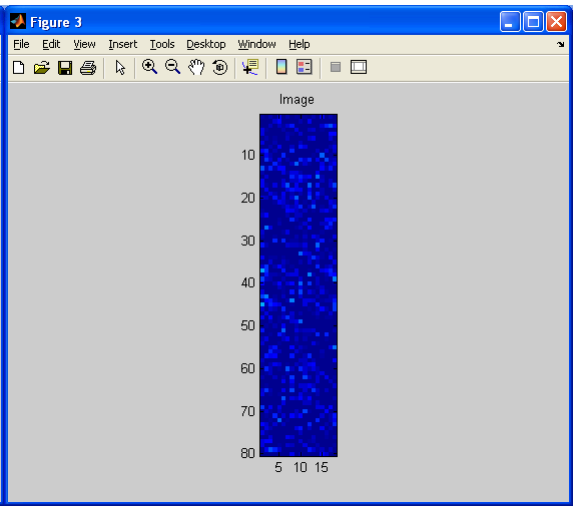

Chirp signal with two perturbations in time  Wigner transform showing linear dependence of frequency w.r.t. time

Start by recording one vowel to use as a gold standard. Should be able to determine if a given wav file contains that same vowel or not by doing correlation between the two Wigner function 2D plots ("corr2")

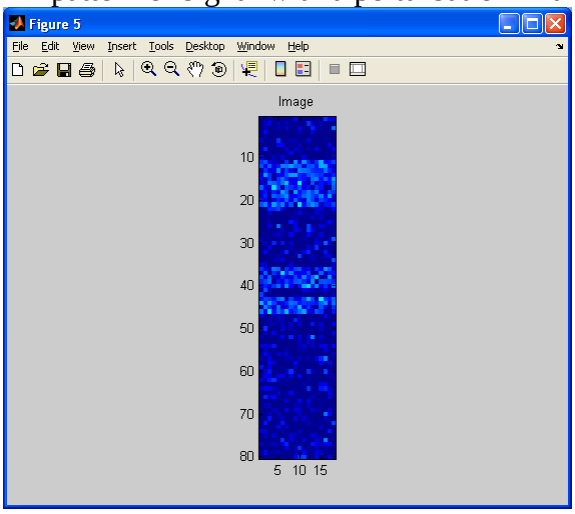
Human voice processing is very intensive, will need to use a very short piece of your recording.

**Option b)**




2D pattern or signal with a perturbation in the lower band  Masked by added noise




Recovered pattern using wavelet transform

The code provided, “perform_wavelet_transform.m”, can perform direct and inverse 2D wavelet transforms. You would need to create your own 2D signal, add noise and do the analysis to recover the signal . Write your own Matlab code, when wavelet transform is needed, call in this subroutine.

```
y = perform_wavelet_transform(x, Jmin, dir, options);
%
%   'x' is either a 1D or a 2D array.
%   'Jmin' is the minimum scale (i.e. the coarse channel is of size
2^Jmin
%       in 1D).
%   'dir' is +1 for fwd transform and -1 for bwd.
%   'options.wavelet_vm' is the number of Vanishing moment (both for
primal and dual).
%   'options.wavelet_type' can be
%       'daubechies', 'symmlet', 'battle', 'biorthogonal'.
```

Nov. 2007

| S | M | T | W | Th | F | Sat. |
|---|---|---|---|---|---|---|
| 4 | 5 | 6<br>Pr. 5 assign | 7 | 8 | 9 | 10 |
| 11 | 12 | 13<br>Pr 5 due<br>Term Pr. | 14 | 15 | 16 | 17 |
| 18 | 19 | 20<br>Term Pr. Prelim report | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | |

Dec. 2007

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| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11<br>Term Pr. due: Pres | 12 | 13<br>Last class Pres. | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |