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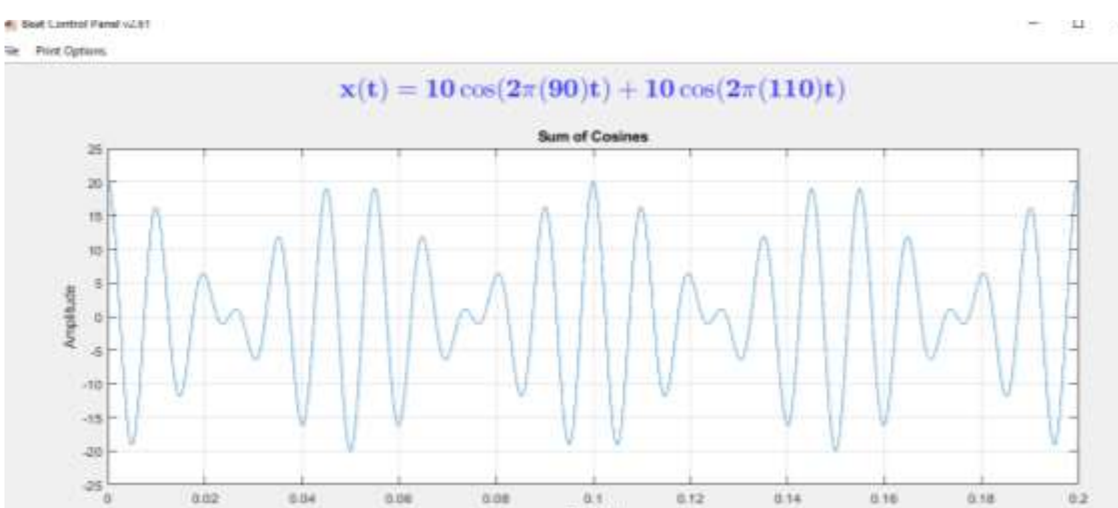
COMPUTER ENGINEERING

4.1

a.

```
function [xx, tt] = beat(A, B, fc, delf, fsamp, dur)

%BEAT compute samples of the sum of two cosine waves
% usage:
% [xx, tt] = beat(A, B, fc, delf, fsamp, dur)
%
% A = amplitude of lower frequency cosine
% B = amplitude of higher frequency cosine
% fc = center frequency
% delf = frequency difference
% fsamp = sampling rate
% dur = total time duration in seconds
% xx = output vector of samples
%--Second Output:
% tt = time vector corresponding to xx

tt=0:1/fsamp:dur;
xx=A*cos(2*pi*(fc-delf)*tt) + B*cos(2*pi*(fc+delf)*tt);
```

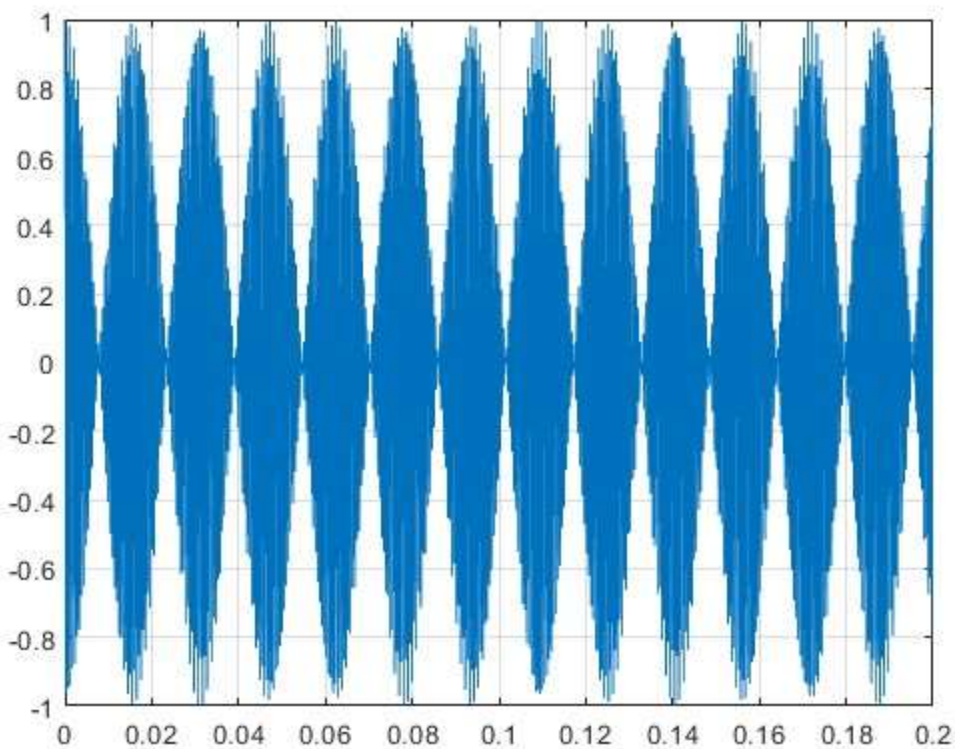
b.



4.2

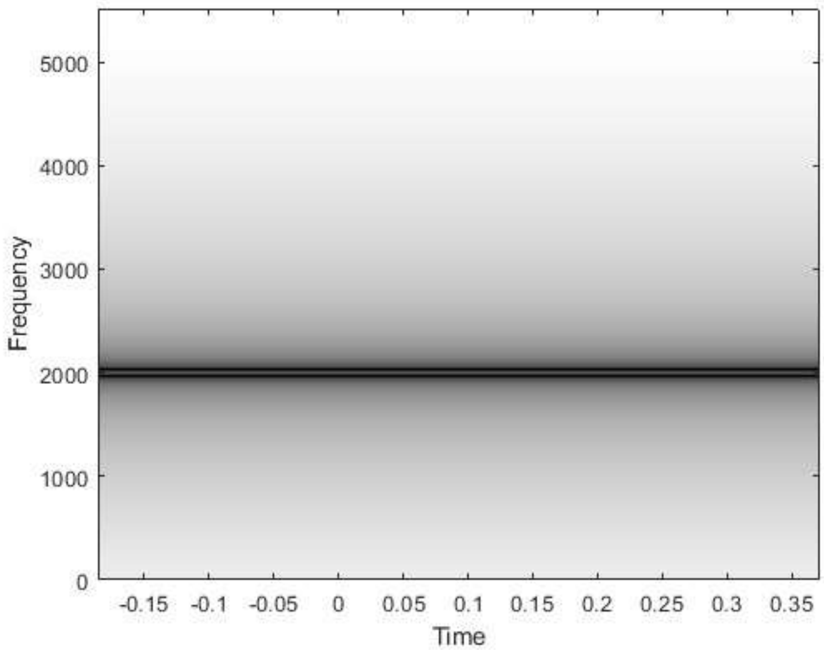
a.

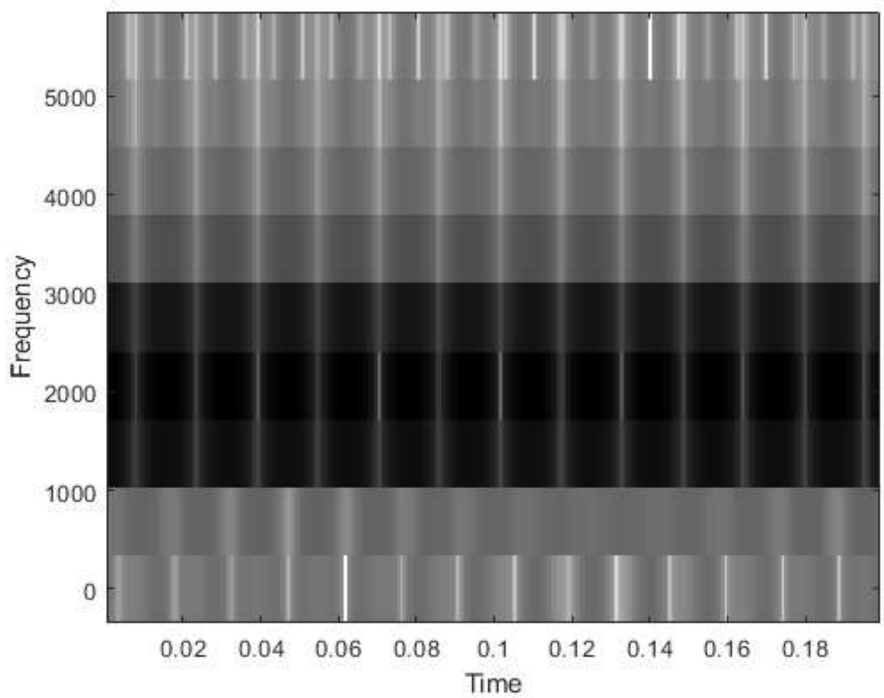
```
delf=32; %Hz

dur = 0.2; %s
fsamp = 11025; %Hz
fc = 2000; %Hz
tt=0:1/fsamp:dur;
xx=cos(2*pi*delf*tt).*cos(2*pi*fc*tt);
plot(tt,xx), grid on;
```



c. With the long section length, it is difficult to see how the frequency content changes with time. Also, the correct frequencies are present in the spectrogram.

d. With short section length, the spectrogram shows how the spectrum varies with time.



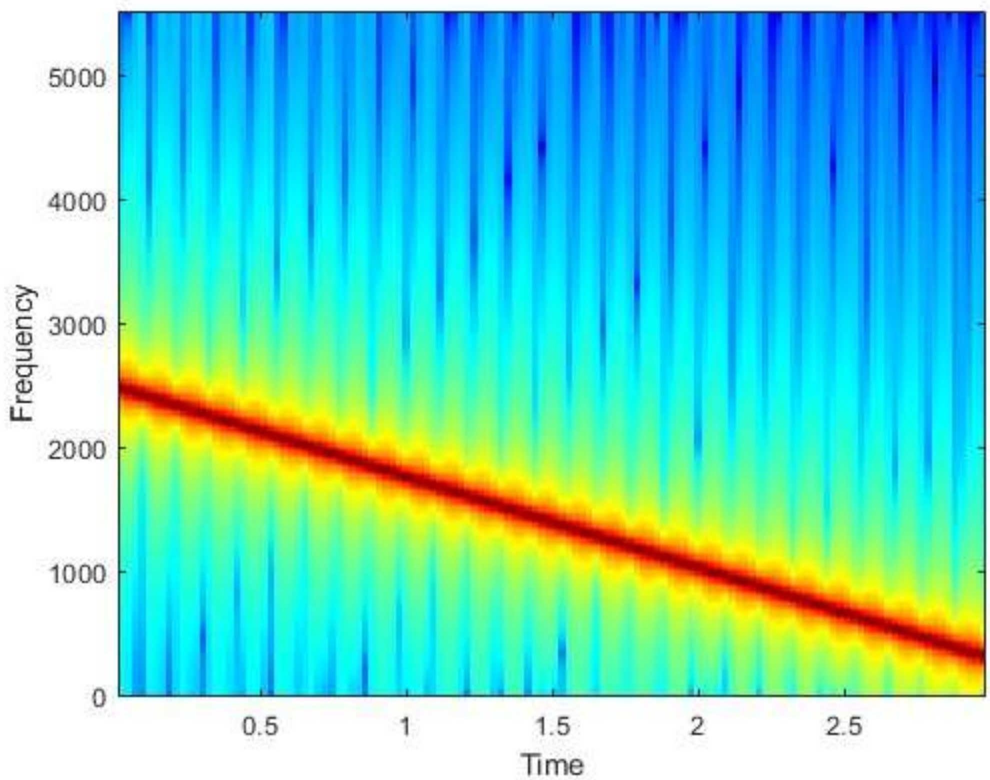


4.3

```
[a,b]=mychirp(5000,300,3,11025);
soundsc(a,fsamp);
```

The frequency movement is linear. It chirps down as time passes on.

```
specgram(a,512,fsamp);
```

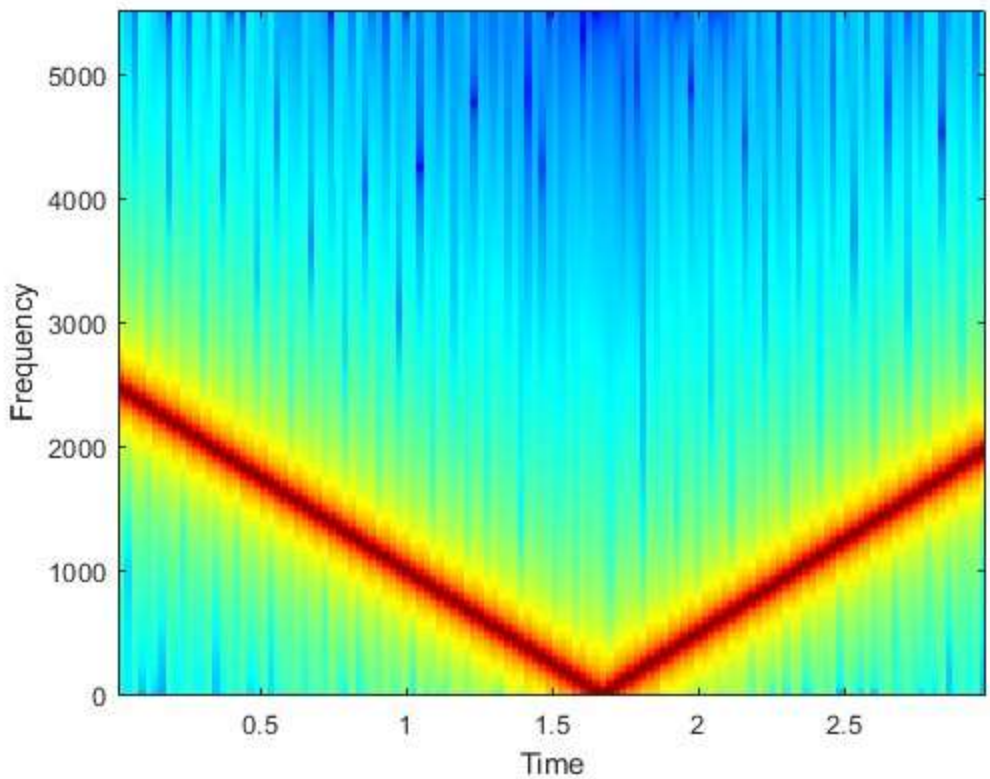


4.4

```
fsamp=11025;
[a,b]=mychirp(3000,-2000,3,11025);
soundsc(a,fsamp);
```

The frequency movement is also linear. It chirps down for some time before chirping up.

```
specgram(a,512,fsamp);
```



Frequency
5000
4000
3000
2000
1000
0
0.5
1
1.5
2
2.5
Time