6.Modify filter\_16.py so that it produces a stereo signal with a different frequency in left and right channels. Use headphones to verify the stereo effect.

**Python code: 6\_my.py**

#16 bit/sample

#y(n) = x(n) -a1 y(n-1) -a2 y(n-2)

from math import cos, pi

import struct

import pyaudio

Fs = 8000

T = 1

N = T \* Fs

f1 = 800

f2 = 100

om1 = 2 \* pi \* float(f1) / Fs

om2 = 2 \* pi \* float(f2) / Fs

r = 0.998

#channel-1(with \_1)

a0\_1 = 1

a1\_1 = -2 \* r \* cos(om1)

a2\_1 = r\*\*2

b0\_1 = 1

b1\_1 = 0

b2\_1 = 0

#channel-2(with \_2)

a0\_2 = 1

a1\_2 = -2 \* r \* cos(om2)

a2\_2 = r\*\*2

b0\_2 = 1

b1\_2 = 0

b2\_2 = 0

y1\_1 = 0.0

y2\_1 = 0.0

y1\_2 = 0.0

y2\_2 = 0.0

gain = 10000.0

p = pyaudio.PyAudio()

stream = p.open(format = pyaudio.paInt16, #16 bits

channels = 2, #stereo

rate = Fs,

input = False,

output = True)

for n in range(0, N):

if n == 0:

x0 = 1.0

else:

x0 = 0.0

y0\_1 = x0 - a1\_1 \* y1\_1 - a2\_1 \* y2\_1 #channel-1

y0\_2 = x0 - a1\_2 \* y1\_2 - a2\_2 \* y2\_2 #channel-2

#delays

y2\_1 = y1\_1

y1\_1 = y0\_1

y2\_2 = y1\_2

y1\_2 = y0\_2

output\_value\_1 = gain \* y0\_1

if output\_value\_1 > 2\*\*15-1:

output\_value\_1 = 2\*\*15-1

elif output\_value\_1 < -2\*\*15:

output\_value\_1 = -2\*\*15

output\_value\_2 = gain \* y0\_2

if output\_value\_2 > 2\*\*15-1:

output\_value\_2 = 2\*\*15-1

elif output\_value\_2 < -2\*\*15:

output\_value\_2 = -2\*\*15

output\_string = struct.pack('h', int(output\_value\_1))

output\_string += struct.pack('h', int(output\_value\_2))

stream.write(output\_string)

print(" \* finished \* ")

stream.stop\_stream()

stream.close()

p.terminate()

**Comment:**

Since we had different frequency in each channel, thus leaded to different coefficient in the equation. So I wrote these two channels individually. Then put the output value in stream one by one.

Firstly, I used f1 = 800, f2 = 400, and run the code with headphones. However it seemed not too much difference between these two channels. Then I changed the frequency f1 =800, f2 = 100, it comes with a clear distinguish between the two channels.