Lab 10 – Sounds and Music Hardware

Link to the LABREPORT:https://www.notion.so/Lab-10-Sounds-and-Music-Hardware-e4e8523a3a144ffe91b9b727a5fc2a2c?pvs=4

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10.1 Familiar sounds

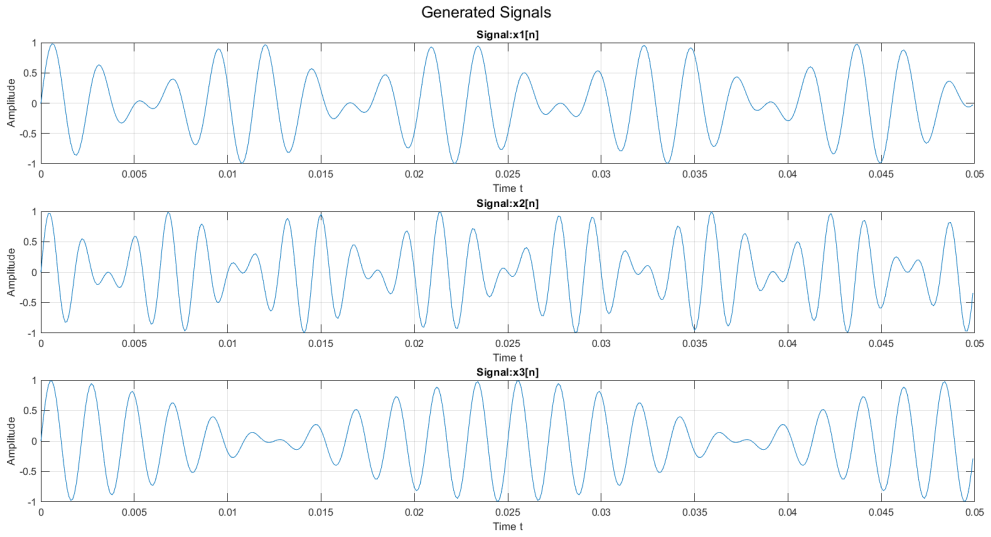
Function:

```
function xn = SineSum(A, F, P, td, fs)
    t = 0:1/fs:td;
    xn = zeros(1,length(t));
    N = length(A);
    for k = 1:1:N
        xn = xn+A(k)*sin((2*pi*F(k)*t)+P(k));
    end
end
```

d)

Yes, the sounds are familiar, These are different sounds in ringing of a mobile in different situations.

e)

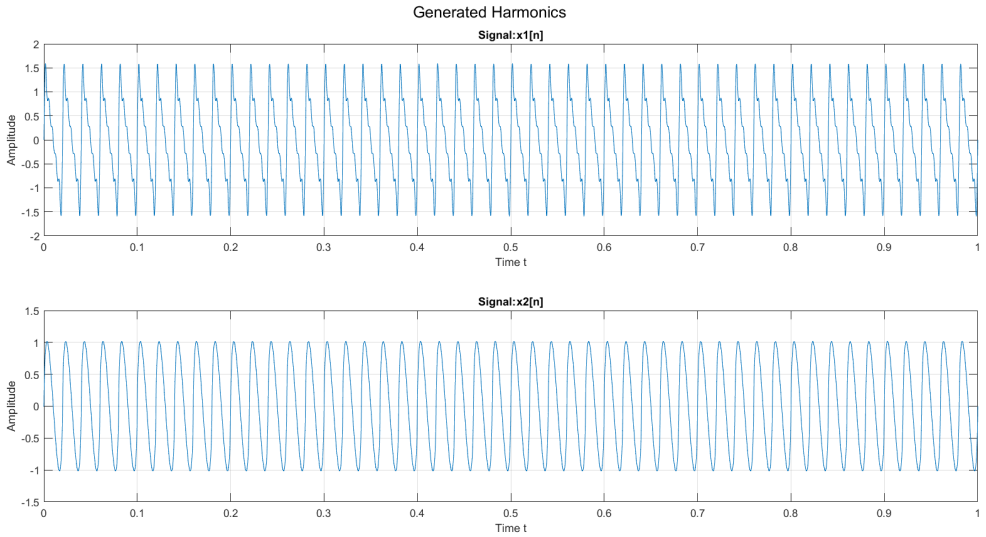


10.2 Creating a signal with harmonics

Function

```
function xn = harmonics(A, f0, P, td, fs)
    t = 0:1/fs:td;
    xn = zeros(1,length(t));
    N = length(A);
    for k = 1:1:N
        xn = xn+A(k)*sin((2*pi*k*f0*t)+P(k));
    end
end
```

e)



First panel for a_k = 1/k and second panel is for a_k = 1/k^2

Audio a:

https://prod-files-secure.s3.us-west-2.amazonaws.com/4c068049-b2ed-4380-8902-95d6b443990c/3b7b08f6-eb35-4f86-94af-f8bdd03db864/Untitled.wav

Audio b:

https://prod-files-secure.s3.us-west-2.amazonaws.com/4c068049-b2ed-4380-8902-95d6b443990c/a0be8d92-c95c-4ba1-90f4-6cec99184b1e/Untitled.wav

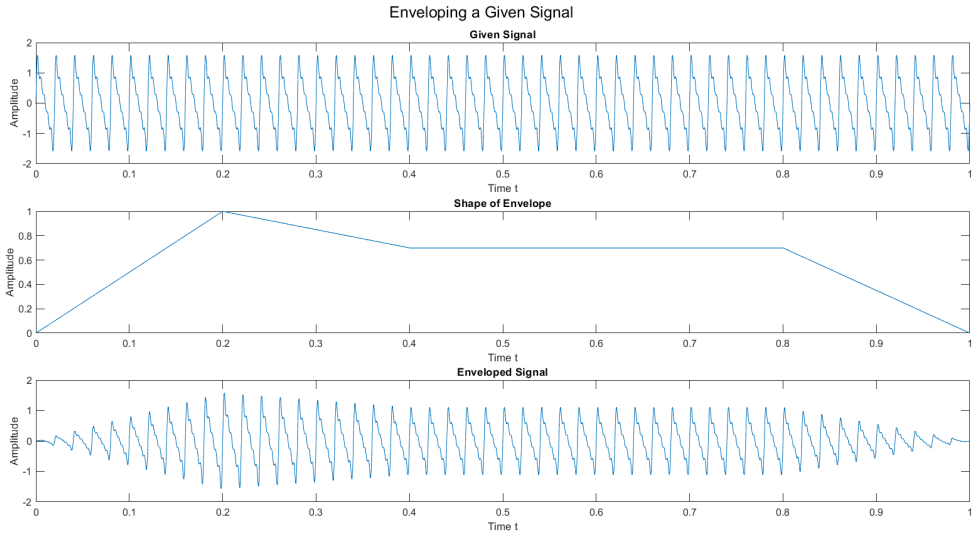
10.3 Creating a signal envelope

Function

```
function [t_env,env] = envelope(a,d,s,sd,r,fs)
    tattack = 0:1/fs:a;
    env_attack = linspace(0,1,length(tattack));
    tdecay = (a+1/fs):1/fs:(a+d);
    env_decay = linspace(1-(d-1/fs)/length(tdecay),s+(d-1/fs)/length(tdecay),length(td
```

```
ecay));
    tsustain = (a+d+1/fs):1/fs:(a+d+sd);
    env_sustain = s*ones(1,length(tsustain));
    trelease = (a+d+sd+1/fs):1/fs:(a+d+sd+r);
    env_release = linspace(s-(r-1/fs)/length(trelease),0,length(trelease));
    t_env = [tattack tdecay tsustain trelease];
    env = [env_attack env_decay env_sustain env_release];
end
```

Plot



10.4 A simple music synthesizer

a) Audio:

https://prod-files-secure.s3.us-west-2.amazonaws.com/4c068049-b2ed-4380-8902-95d6b443990c/86cccd64-02fc-4140-b4fe-65698d26ae34/Untitled.wav

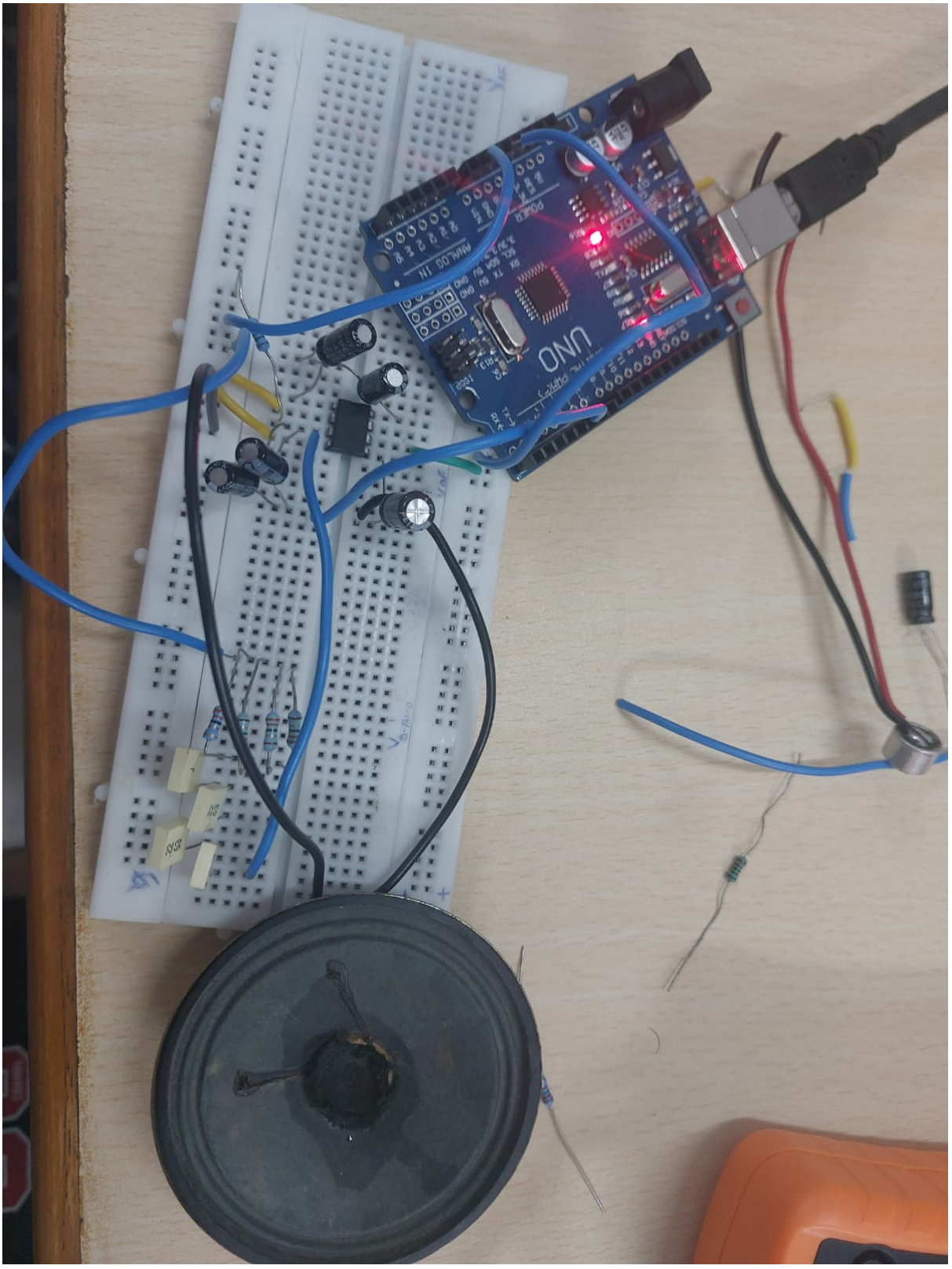
b) Audio:

https://prod-files-secure.s3.us-west-2.amazonaws.com/4c068049-b2ed-4380-8902-95d6b443990c/e1f1a51d-1e8a-4603-b70f-97b68b82119d/Untitled.wav

c) Audio:

10.5 Hardware Implementation

Testing the Speaker Circuit:




```
clear;
f = [2400 4000 12000 24000 ];
a = arduino('COM5',' Uno','Libraries','Servo');
for k = 1:length(f)
    playTone(a,"D5",f(k),5);
```

```
    pause(5.1);
    clear;
end
```