

LAB REPORT-5

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$$Q_1 \quad x(t) = \begin{cases} 5(1-t) & 0 \leq t \leq 1 \\ 0 & 1 < t \leq 2 \end{cases},$$

$$T=2$$

Sol \rightarrow Coefficient of Fourier transformation:

$$a_k = \frac{1}{T} \int_0^T x(t) e^{-j\omega_k t} dt$$

$$\Rightarrow a_k = \frac{1}{2} \int_0^1 5(1-t) e^{-j\pi \left(\frac{2\pi}{T}\right) kt} dt + 0$$

$$= \frac{1}{2} \int_0^1 5(1-t) e^{-j\pi kt} dt$$

$$= \frac{5}{2} \left[\int_0^1 e^{-j\pi kt} dt - \int_0^1 t e^{-j\pi kt} dt \right]$$

$$= \frac{5}{2} \left[\frac{e^{-j\pi kt}}{-j\pi k} \right]_0^1 - \frac{5}{2} \left[\int_0^1 t e^{-j\pi kt} dt \right]$$

$$= \frac{\bar{s}}{2} \left(\frac{e^{-j\pi k} - 1}{-j\pi k} \right) - \frac{\bar{s}}{2} \left\{ \frac{te^{-j\pi kt}}{-j\pi k} - \int \frac{e^{-j\pi kt}}{-j\pi k} dt \right\} \Big|_0^1$$

$$= -\frac{\bar{s}(e^{-j\pi k} - 1)}{2j\pi k} - \frac{\bar{s}}{2} \left\{ \frac{te^{-j\pi kt}}{-j\pi k} - \frac{e^{-j\pi kt}}{(j\pi k)^2} \right\} \Big|_0^1$$

$$= \frac{\bar{s}}{2} \left(\frac{e^{-j\pi k} - 1}{j\pi k} \right) - \frac{\bar{s}}{2} \left[\frac{e^{-j\pi k} - 1}{-j\pi k} - \left(\frac{e^{-j\pi k} - 1}{(j\pi k)^2} \right) \right]$$

$$= \frac{\bar{s}}{2} \left[\frac{1}{j\pi k} + \frac{1}{j^2 \pi^2 k^2} - \frac{e^{-j\pi k}}{j^2 \pi^2 k^2} \right]$$

Q2 $f(t) = \begin{cases} t, & -1 \leq t < 1 \\ 0 & \text{elsewhere} \end{cases}, \quad T=2$

$$a_k = \frac{1}{T} \int_0^T f(t) e^{-jk\omega_0 t} dt$$

$$\omega_0 = \frac{2\pi}{T} = \pi$$

$$a_k = \frac{1}{2} \int_{-1}^1 t e^{-jk\omega_0 t} dt$$

$$= \frac{1}{2} \left[\frac{t e^{-jk\pi t}}{-j\pi k} - \int \frac{e^{-jk\pi t}}{-j\pi k} dt \right]_{-1}^1$$

$$= \frac{1}{2} \left[\frac{t e^{-jk\pi t}}{-j\pi k} - \frac{e^{-jk\pi t}}{(j\pi k)^2} \right]_{-1}^1$$

$$= \frac{1}{2} \left[\frac{e^{-j\pi k} - e^{+j\pi k}}{(-j\pi k)} - \frac{e^{-j\pi k} - e^{j\pi k}}{(j\pi k)^2} \right]$$

Q3 $x(t) = \begin{cases} 1 & 0 < t < 1 \\ -1 & 1 \leq t < 2 \end{cases}, T=2$

$$a_k = \frac{1}{T} \int_0^T x(t) e^{-jk\omega_0 t} dt$$

$$\omega_0 = \frac{2\pi}{T} = \pi$$

$$a_k = \frac{1}{2} \int_0^1 e^{-jk\pi t} dt - \frac{1}{2} \int_1^2 e^{-jk\pi t} dt$$

$$= \frac{1}{2} \left(\frac{e^{-jk\pi} - 1}{-jk\pi} \right) - \frac{1}{2} \left(\frac{e^{-2jk\pi} - e^{-jk\pi}}{-jk\pi} \right)$$

$$= \frac{1}{2} \left[\frac{e^{-jk\pi} + 1}{jk\pi} + \frac{e^{-2jk\pi} - e^{-jk\pi}}{jk\pi} \right]$$

$$= \frac{1}{2} \left[\frac{1}{jk\pi} + \frac{e^{-2jk\pi} - 2e^{-jk\pi}}{jk\pi} \right]$$

$$L = T$$

$$1 > k > 0$$

$$L > k \geq 1$$

$$1 -$$

$$1 -$$

$$1 - = (k) \times \quad \text{exp}$$

$$Lb \quad \text{exp} \quad \left[\frac{1}{T} - 1 \right]$$

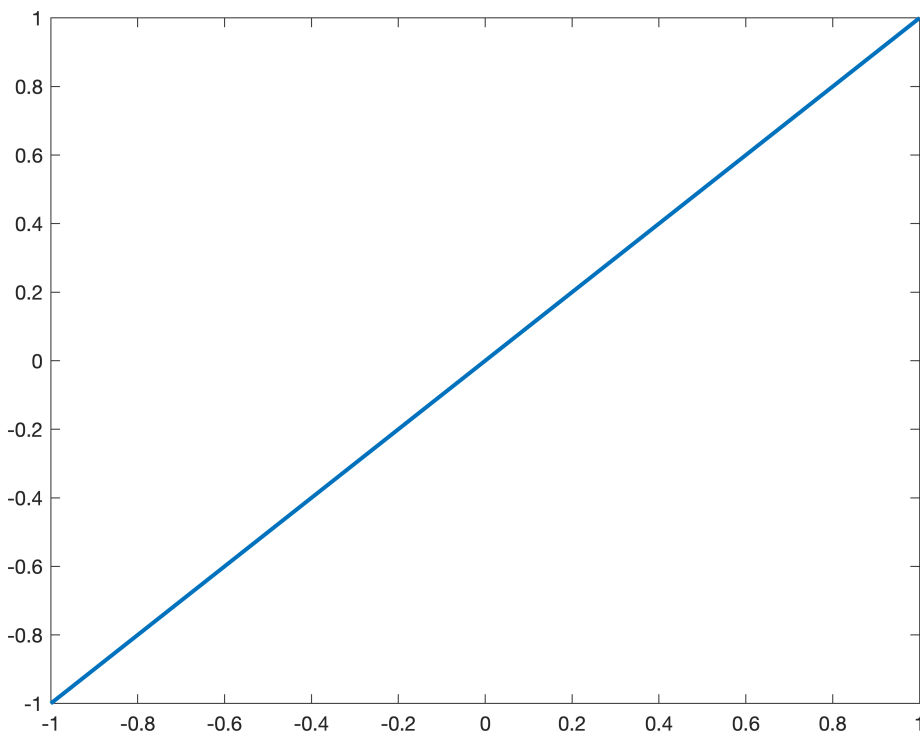
$$T = \frac{Lb}{T} = \omega$$

Anushtan Saxena

```

close all;
clear;
clc;
f = [];
count = 1;
for t = -1:0.01:1
    f(count) = t;
    count = count+1;
end
t = -1:0.01:1;
plot(t,f, 'LineWidth', 2);

```



```

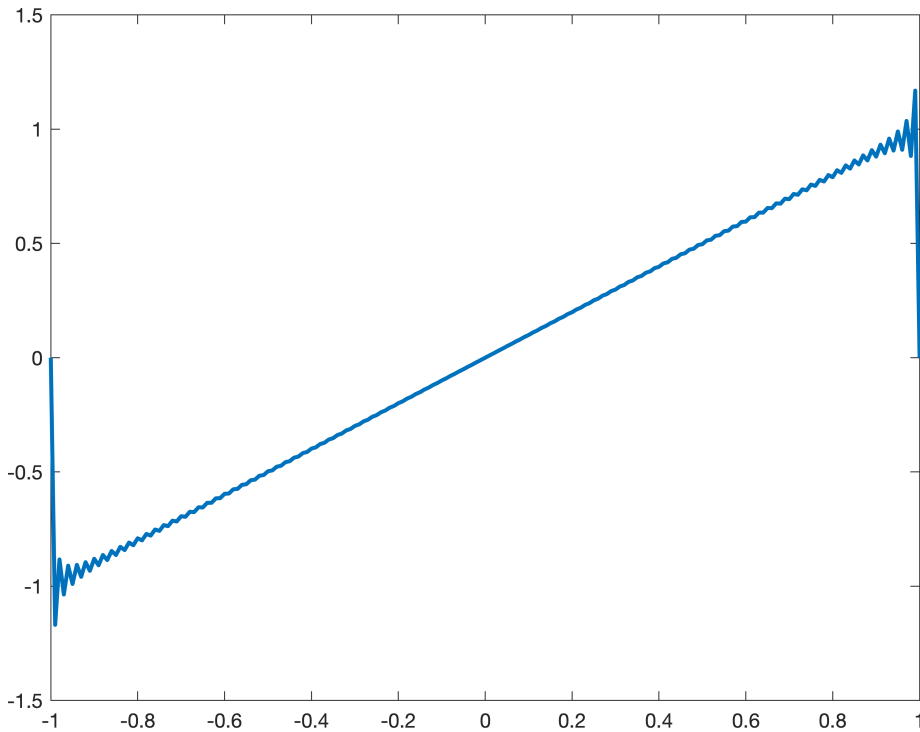
c = 0;
ans = [];
count = 1;
for t = -1:0.01:1
    c = 0;
    for k = -100:1:100
        coeff = @(t) 0.5*t.*exp(-1j*pi*t*k);
        c = c+(exp(1j*pi*k*t).*integral(coeff,-1,1));
    end
    if(t>0)

```

```

        ans(count) = abs(c);
    else
        ans(count) = -abs(c);
    end
    count = count+1;
end
t = -1:0.01:1;
plot(t,ans, 'LineWidth', 2);

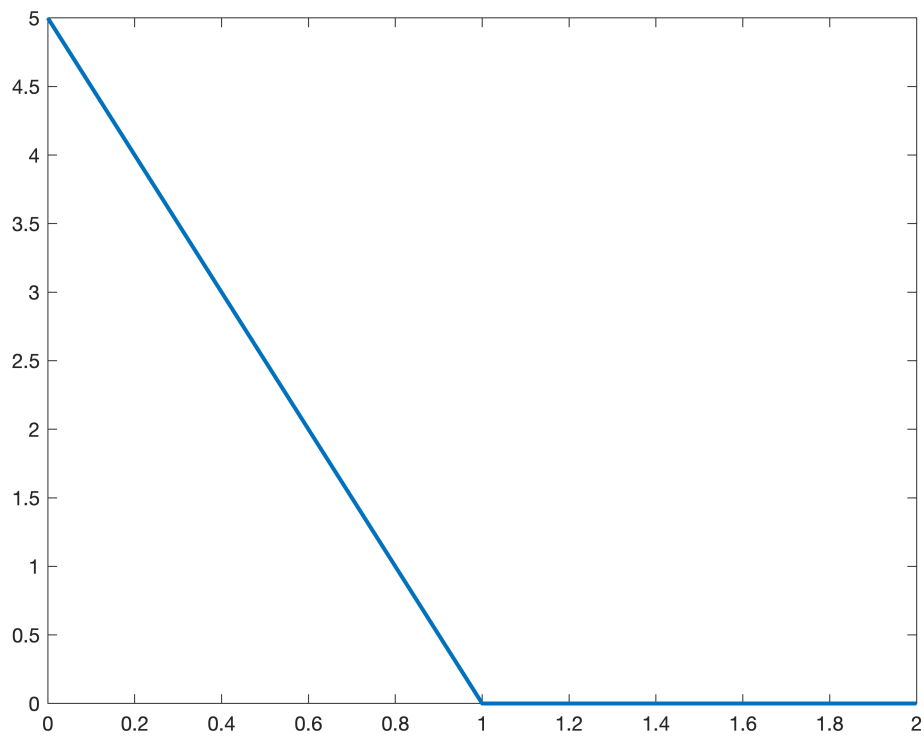
```



```

clear;
clc;
f = [];
count = 1;
for t = 0:0.01:1
    f(count) = 5*(1-t);
    count = count + 1;
end
for t = 1.01:0.01:2
    f(count) = 0;
    count = count + 1;
end
t = 0:0.01:2;
plot(t,f, 'LineWidth', 2);

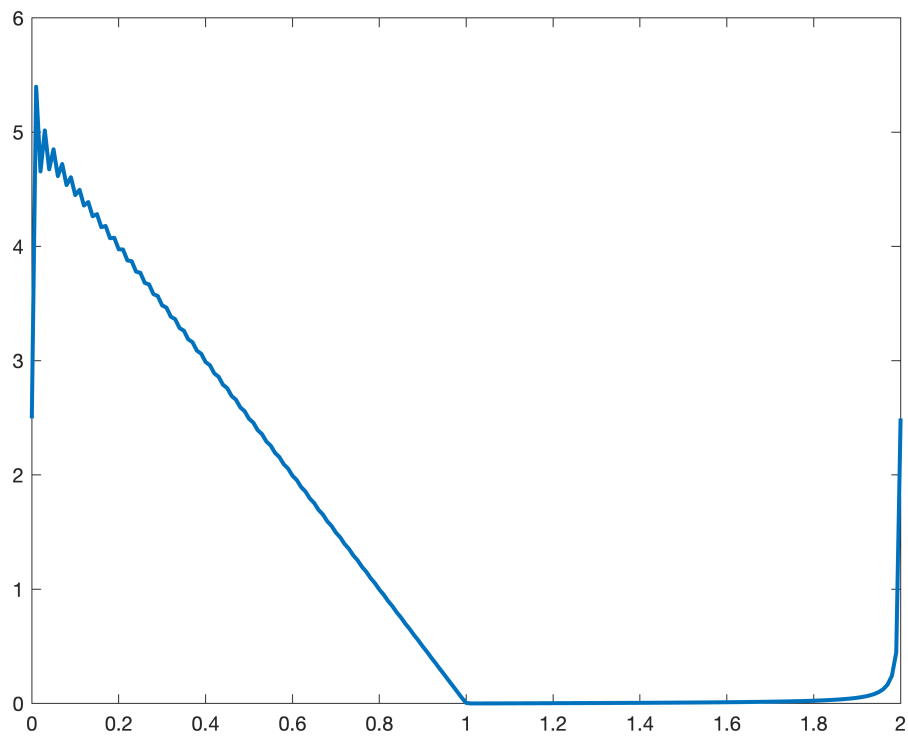
```



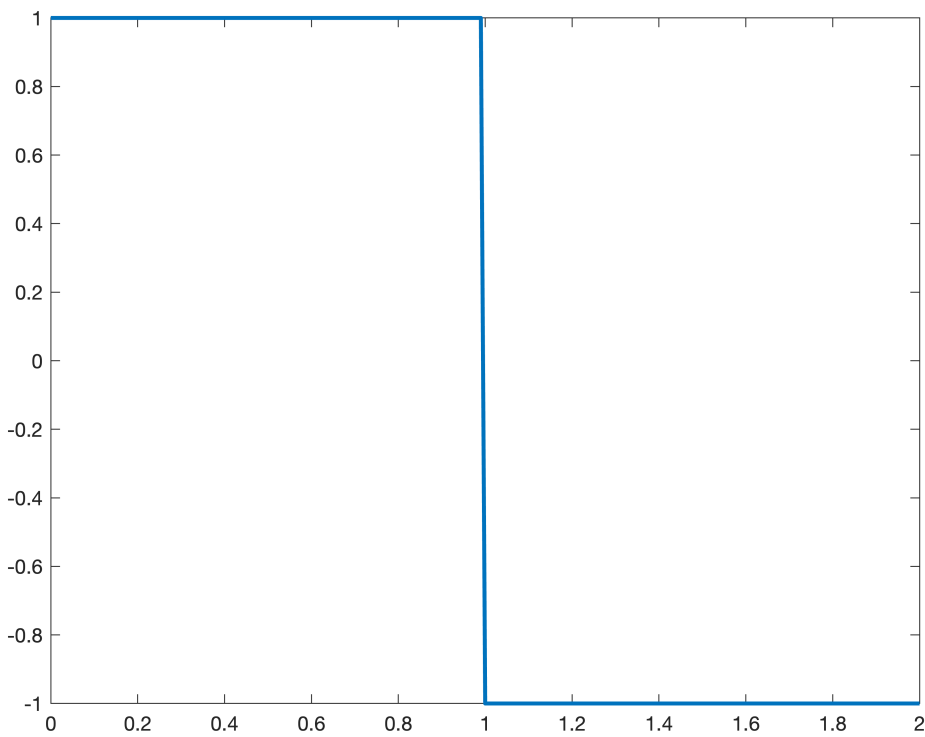
```

c = 0;
ans = [];
count = 1;
for t = 0:0.01:2
    c = 0;
    for k = -100:1:100
        coeff = @(t) 2.5*(1-t).*exp(-1j*pi*t*k);
        c = c+(exp(1j*pi*k*t).*integral(coeff,0,1));
    end
    ans(count) = abs(c);
    count = count + 1;
end
t = 0:0.01:2;
plot(t,ans, 'LineWidth', 2);

```



```
clear;
clc;
f = [];
count = 1;
for t = 0:0.01:0.99
    f(count) = 1;
    count = count + 1;
end
for t = 1:0.01:2
    f(count) = -1;
    count = count + 1;
end
t = 0:0.01:2;
plot(t,f, 'LineWidth', 2);
```

```

c = 0;
ans = [];
count = 1;
for t = 0:0.01:2
    c = 0;
    for k = -100:1:100
        coeff1 = @(t) 0.5*exp(-1j*pi*t*k);
        coeff2 = @(t) -0.5*exp(-1j*pi*t*k);
        c = c+(exp(1j*pi*k*t).*(integral(coeff1,0,1)+(integral(coeff2,1,2))));
    end
    if(t < 1)
        ans(count) = abs(c);
    else
        ans(count) = -abs(c);
    end
    count = count + 1;
end
t = 0:0.01:2;
plot(t,ans, 'LineWidth', 2);

```

