classmate

Date

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Lab-5 CT-III

1) **Plotting the complex-phasor.**

Observation:-

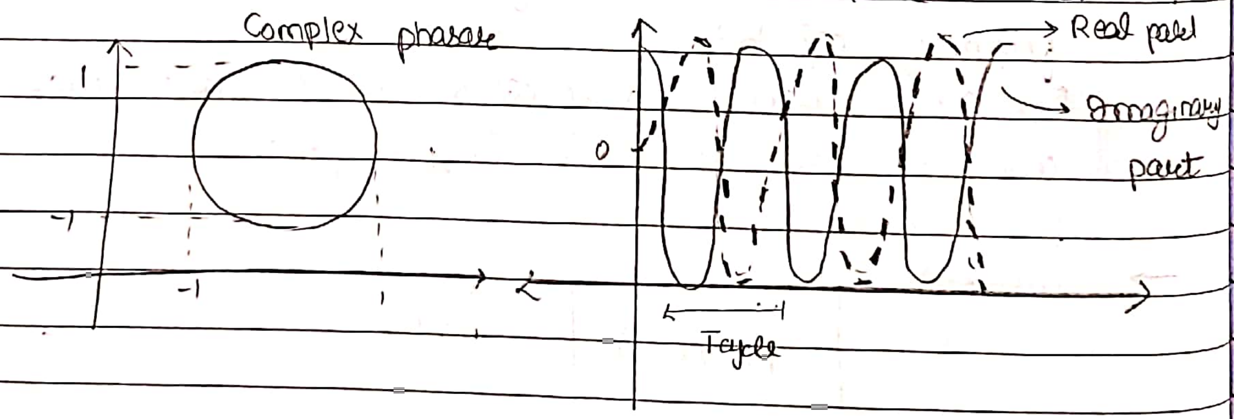
i) On increasing Tsample ⇒ we are ~~increasing~~ decreasing the discritized point (or Nsample) in Ttotal time. hence the graph we get is not approximated properly and not of proper shape

$\boxed{\therefore \text{ Tsample should be low enough.}}$

ii) On increasing Amplitude ⇒ on increasing amplitude we are just increasing the height of the present waveform

iii) On increasing frequency ⇒ on increasing frequency we are just increasing no. of cycle that are present between 0 to Ttotal time.

And complex phasor becomes more thicker



2) **Analyzing the signal:-**

Observation:

→ The signal which we obtain in time-domain has anonymous frequency & amplitude ∴ we convert it in freq domain using fourier transform

* Difference b/w F.T of $s(t)$, $s_r(t)$ & $s_i(t)$

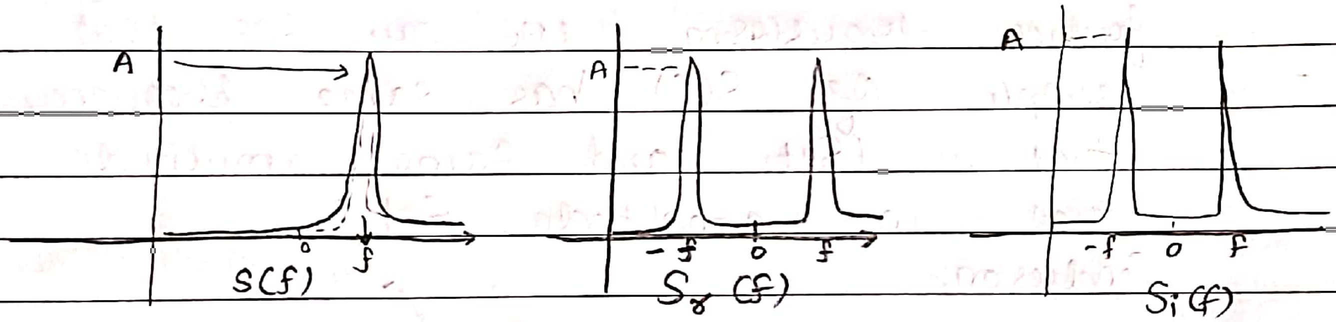
1) $S(f)$ represent the frequency present along with amplitude with F.T as dirac pulse $\delta(f - f_c)$ just one freq f_c.

2) We know that F.T of $\sin(2\pi f_c t)$ is $\frac{1}{2j}(\delta(f-f_c) - \delta(f+f_c))$ so we will get the twice the no. frequence present that in S(f) are will be almost mirror image w.r.t to y-axis and amplitude will be $\frac{1}{2}$.

3) Same as that in (2) as we get F.T of $\cos(2\pi f_c t)$ as $\frac{1}{2}(\delta(f+f_c) + \delta(f-f_c))$ and hence there are two frequencies peak present.

⇒ On INCRESING f :-

We will see that the S(f) curve shifting to right at the given frequency value and amplitude almost remain same with just slight decrement.



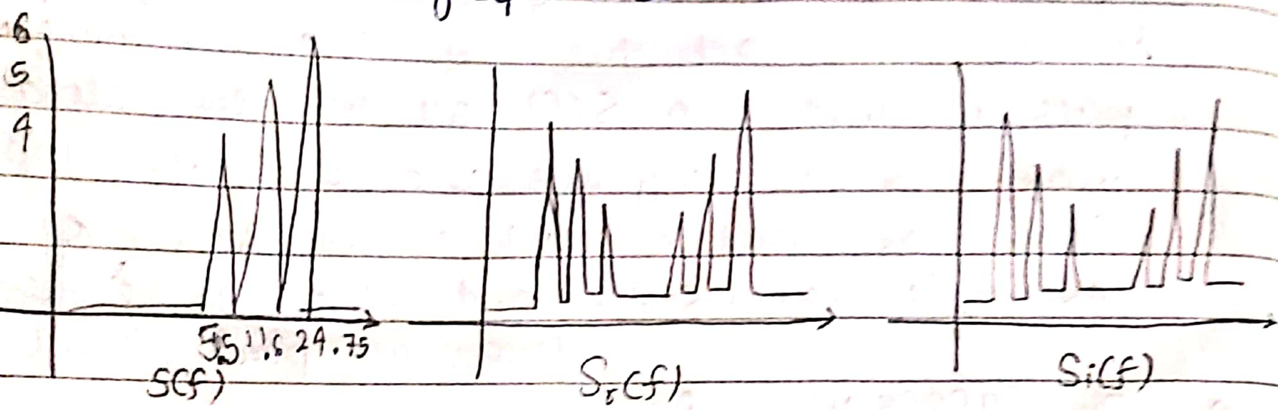
3) Determing the frequencies & Amplitude present by doing F.T

Observation:-

We can see that in time-domain we couldn't do proper anlysis of frequencies and amplitude so we convert it into freq. domain and could easily find it.

frequency-1 ⇒ 5.556	Amplitude ⇒ 4
frequency-2 ⇒ 11.62	Amplitude ⇒ 5
frequency-3 ⇒ 24.75	Amplitude ⇒ 6

The respective graph are :-



4) Creating our own signal:-

Observation:-

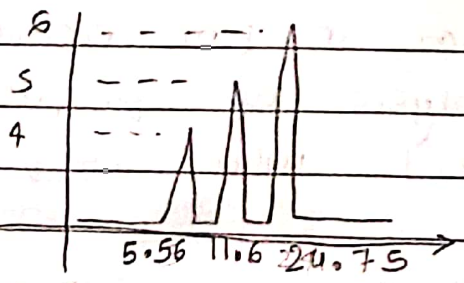
After generating the signal if we do the fourier transform we can see that the graph of S(f) has same frequency as that in fSet and same amplitude as that in amplitude_Set.

Conclusion:-

Hence we can see the value of ~~frequencies~~ and amplitude match between F.T of our graph and f_set and Amplitude_set value.

just slight difference in ~~the~~ decimal of frequency

e.g. f_set = [5 11 24] amplitude_set = [4 5 6]



→ for S(f) ⇄ S(t)

5) Generating the Rectangular Pulse

Observation:-

→ On fourier transform of rectangular pulse we get a sinc function.

WHEN CONTINOUS - SPECTRUM?

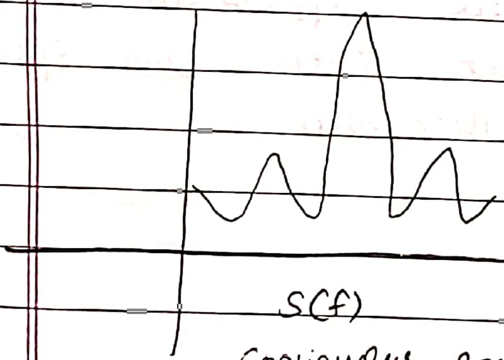
On Observation it is found when the wave is aperiodic or just one cycle is present then we get continuous frequency Spectrum of the rectangular - pulse.

WHEN LINE - SPECTRUM?

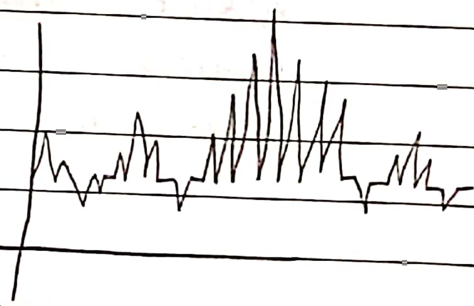
When the wave is periodic, then according to $\boxed{\text{Sampling THEOREM AND Duality law}}$, periodic in time domain ⇒ Sampling in frequency domain and hence we will get line- Spectrum.

→ Also speration between Spectral line is the inverse of time period - T ∴ On increasing T Speration decreases and vice versa.

$s(t) = \Pi\left(\frac{t}{T}\right)$



Continuous Spectrum



Line - Spectrum

6) Implemeting triangular functions:-

// My Code here

```
⇒ function [s,t] = triSignalGenerator (Ttotal, Tsample, Ton, Toff, amp.)
Nsamples = ceil ( Ttotal / Tsample);
Non = ceil ( Ton / Tsample);
Noff = ceil ( Toff / Tsample);
N1cycle = Non + Noff
Ncycles = ceil (Nsamples / N1cycle);
```

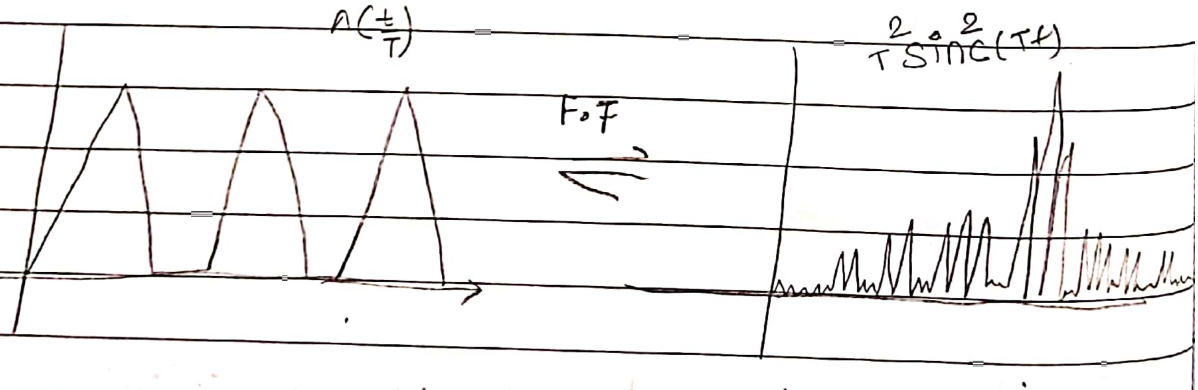
generating this line

```
t = linspace(0, Ton, Non+1);
a = 2*(abs( t(1:floor(Non/2)))) / Ton;
a = a';
b = 2-2*(abs( t((ceil(Non/2)+1):Non))) / Ton;
b = b';
c = zeros(Noff, 1);
S = [a; b; c];
S = reshape(repmat(S,1,Ncycles),1,Ncycles*N1cycle);
S = amplitude*S(1:Nsamples);
t = linspace(0, Ttotal - Tsample, Nsamples);
end.
```

generating

OBSERVATION:-

On fourier Analysis, we get square of sinc f^n i.e. $sinc^2(Tf)$
Here also aperiod triangular wave result into continuous spectrum and period wave result into line-spectrum due to sampling theorem.



7) **Generating train of Dirac Delta impulses:-**

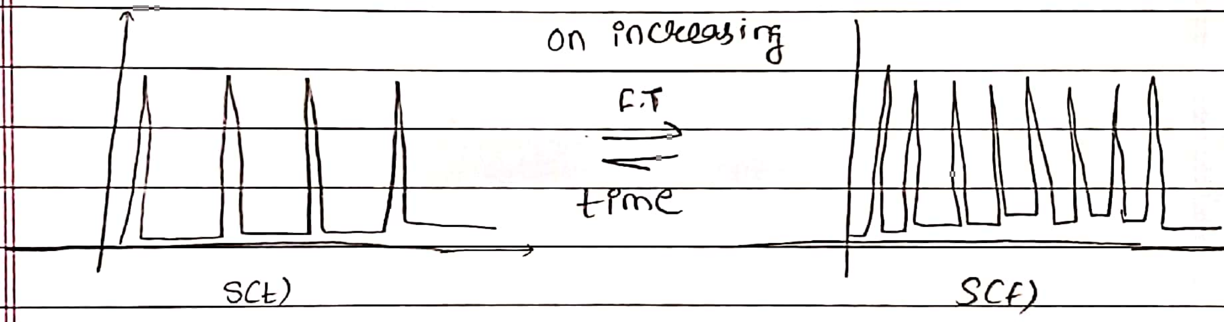
// My Code

```
NimpTotal = 5;
Nperiod = 0.5;
Tsample = 0.01;
a = [1   zeros(1, ((Nperiod/Tsample)-1))];
Ttotal = Nimptotal * Nperiod;
```

```
a= repmat(a,1,NimpTotal);
t=linspace(0, Ttotal, Nsamples);
plot(t,a);
```

Observation:-

On fourier transform of the above case we get the again the train of dirac delta impulse in freq. domain but with different seperation. we can see that on increasing seperation in time-domain the seperation in frequency decreases (i.e come more closer).



8) SYNTHESIS OPERATION (Inverse F.T)

Observation

$$x(t) \rightleftharpoons X(f)$$
$$X(f) \rightleftharpoons x(-t)$$
$$x(-t) \rightleftharpoons X(-f)$$
$$X(-f) \rightleftharpoons x(t)$$

$\therefore$ Total 4 times ~~transf~~ fourier transform of a signal result in same signal

In order to get original signal from its F.T :-

```
function [a] = myInverseFourierTransform(s, Nsamples)
    S=fft(S); S=fftshift(S);
    S=fft(S); S=fftshift(S);
    S=fft(S); S=fftshift(S)/Nsamples;
    a=S;
end.
```

Since we are passing as an argument the fourier transform of original pulse so we need to F.T take it's fourier transform twice in order to retrieve back the signal.