Date 5/3/21 Expt. No. 6

Expt. Name Fourier transform Page No. 11

Experiment - 6

Fourier Transform

Aim:

To observe the effect of amplitude and frequency variation of fourier transform of following waveforms;

- sine wave, cosine wave,
- triangular wave,
- sawtooth wave,
- square wave.

Theory:

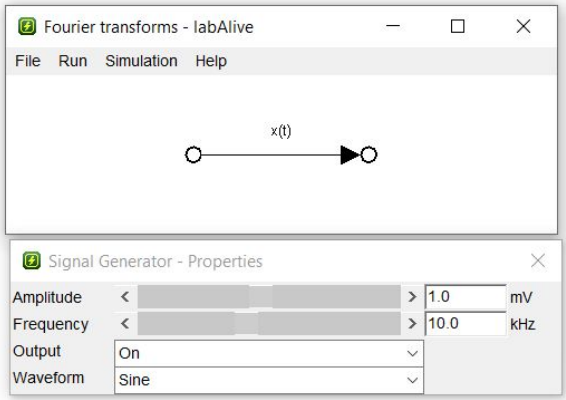
Fourier transform is simply a method of expressing a function in terms of the sum of its projections onto a set of basis functions. Since an image is only defined on a closed and bounded domain, it is integrable over real line.

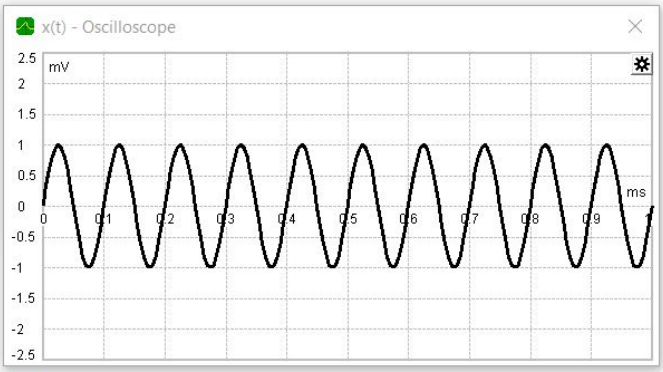
$$\hat{f}(\xi) = \int_{-\infty}^{\infty} f(x)\, e^{-2\pi i x \xi}\, dx .$$

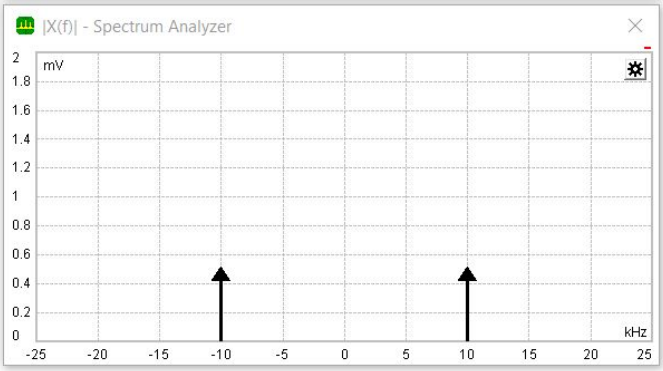
The result is a Dirac Delta function at $\xi = \xi_0$, which is the only frequency component of the sinusoidal signal $e^{2\pi i \xi_0 x}$.

Teacher's Signature:

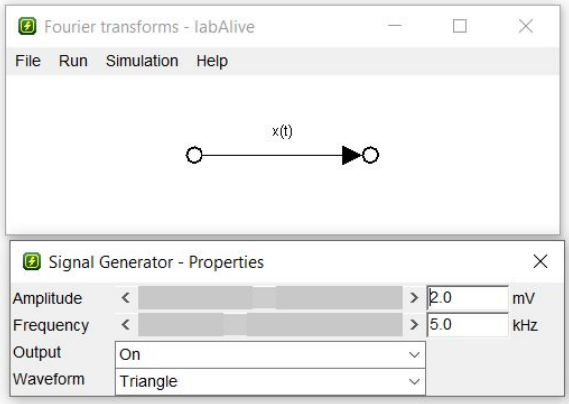
Sine, Cosine Wave

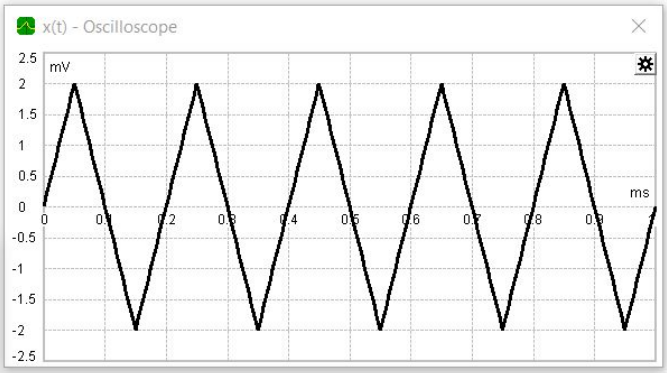


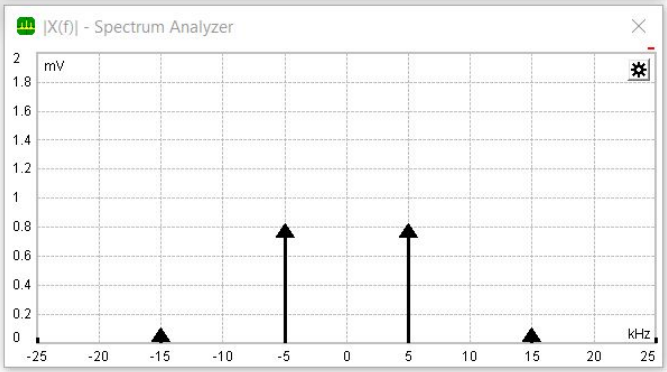




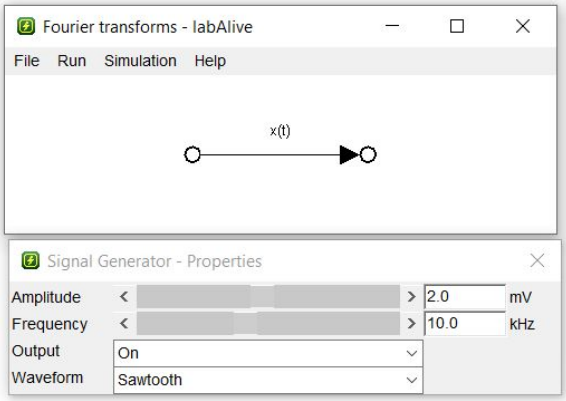
Triangular Wave

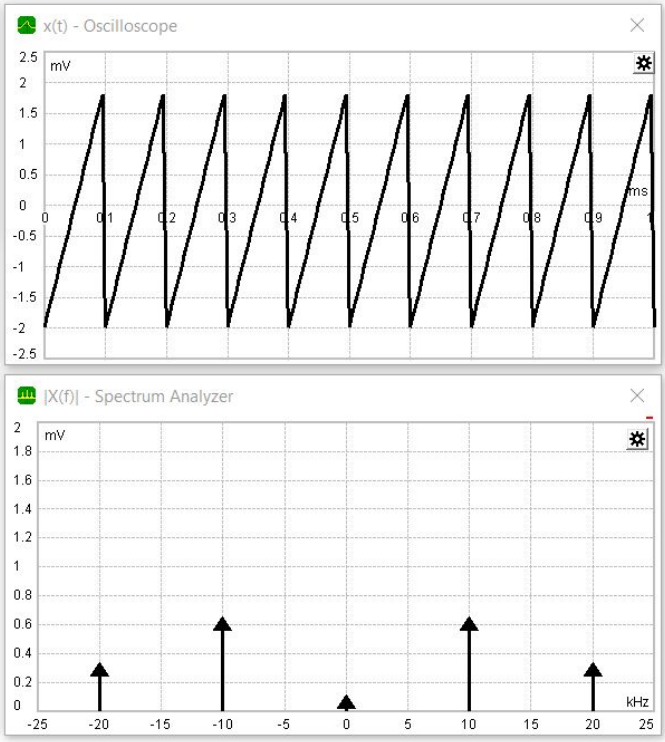




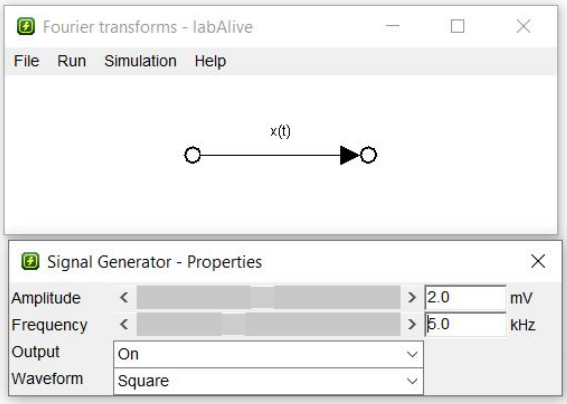


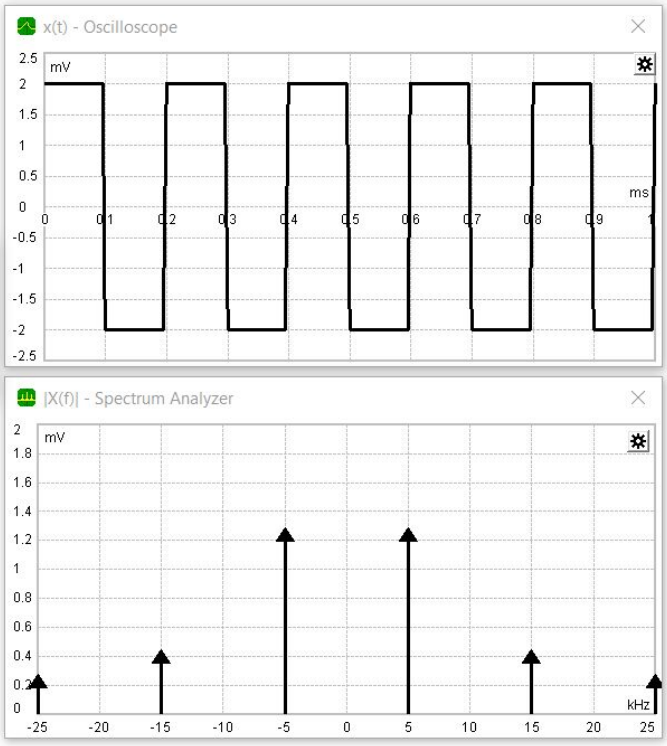
Sawtooth Wave





Square Wave





Date

Expt. No.

Expt. Name

Page No.

Procedure :

- Start the simulator.
- Vary frequency and amplitude, and take the readings for sine, cosine, sawtooth, triangular and square wave.

Observations :

- The spectrum was observed for different values of amplitude and frequency for different waveforms.
- for sine wave, the value of amplitude was reduced to half, spectrum shows both extremes.
- for cosine wave, result were same as sine wave.
- for triangular wave, the value of amplitude reduces by 0.4, spectrum will appear one after skipping other.
- Sawtooth wave will transform as

$$x_{sawtooth} = \frac{1}{2} - \frac{1}{\pi} \sum \left(\frac{\sin(2\pi k f(t))}{k} \right)$$

- Square wave will follow

$$a_n = \frac{2A}{n\pi} \sin\left(n\pi/2\right).$$

Teacher's Signature: