Signals & System

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Course - Signals & system

Name - Rashmi. K

USN - 4AL18EC043

Sem - IV Sem.

Report :

Fourier Transform :

co-ordinate transform - $u(x, y, t)$

$u_t = \alpha \nabla^2 u$

* Now we have fast fourier transform (FFT)

discrete fourier transform:

$f(t) = \frac{1}{2} a_0 + \sum_{k=1}^{\infty} (a_k \cos 2\pi kt + b_k \sin 2\pi kt)$

* 20 to 20KHz of human hearing.
* $x(F) = \int_{-\infty}^{\infty} \underbrace{x(t)}_{\text{function}} e^{-j2\pi Ft} \, dt$

$x_a(F) = \int_{-\infty}^{\infty} x(t) \cos 2\pi Ft \, dt$ $\quad$ $x_b(F) = \int_{-\infty}^{\infty} x(t) \sin 2\pi Ft \, dt.$

continous $X(F) = \int_{-\infty}^{\infty} x(t) e^{-j2\pi Ft} \, dt$

discrete $X_k = \sum_{n=0}^{N-1} x_n \cdot e^{\frac{-j2\pi kn}{N}}$

euler's formula $e^{jx} = \cos x + j \sin x$

Fourier Series T :

* $f(x) = \frac{A_0}{2} + \sum_{k=1}^{\infty} (A_k \cos(kx) + B_k (\sin(kx)))$

$A_k = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) \cos(kx) \, dx.$

$B_k = \frac{1}{\pi} \int_{-\pi}^{\pi} f(x) \sin(kx) \, dx.$

periodic

$$f(x) = \frac{A_0}{2} + \sum_{k=1}^{\infty} \left(A_k \cos\left(\frac{2\pi k x}{L}\right) + B_k \sin\left(\frac{2\pi k x}{L}\right) \right)$$

$$A_k = \frac{2}{L} \int_0^L f(x) \cos\left(\frac{2\pi k x}{L}\right) dx$$

$$B_k = \frac{2}{L} \int_0^L f(x) \sin\left(\frac{2\pi k x}{L}\right) dx.$$

Inner product

$$\langle f(x), g(x) \rangle = \int_a^b f(x)\, \bar{g}(x)\, dx.$$

$$\langle f, g \rangle \Delta x = \sum_{k=1}^{n} f(x_k)\, \bar{g}(x_k)\, \Delta x$$

Complex fourier series:

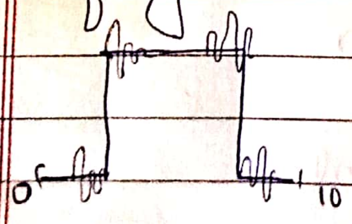
$$f(x) = \sum_{k=-\infty}^{\infty} c_k e^{ikx} = \sum_{k=-\infty}^{\infty} (\alpha_k + i\beta_k)(\cos(kx) + i \sin(kx))$$

Using matlab:
- define function
- using hat function

Using phython:
- define hat function
- compute fourier series

Fourier series and Gibbs Phenomenon :

defining function $L = 0 - 10$ $N = 1024$.



Which have discontinuity in frequency.