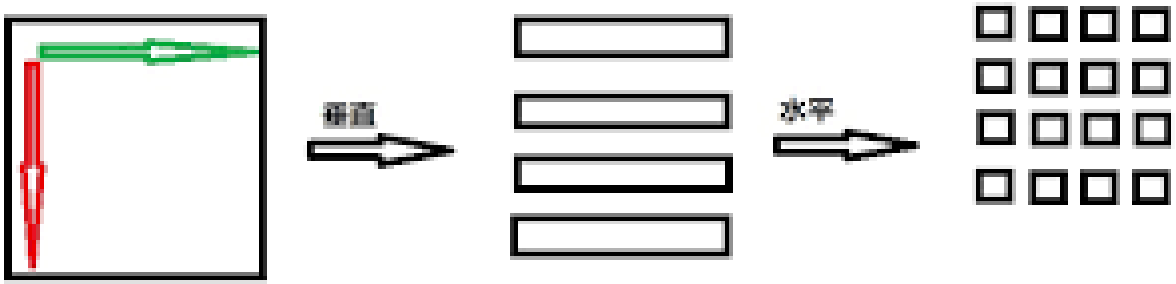
SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

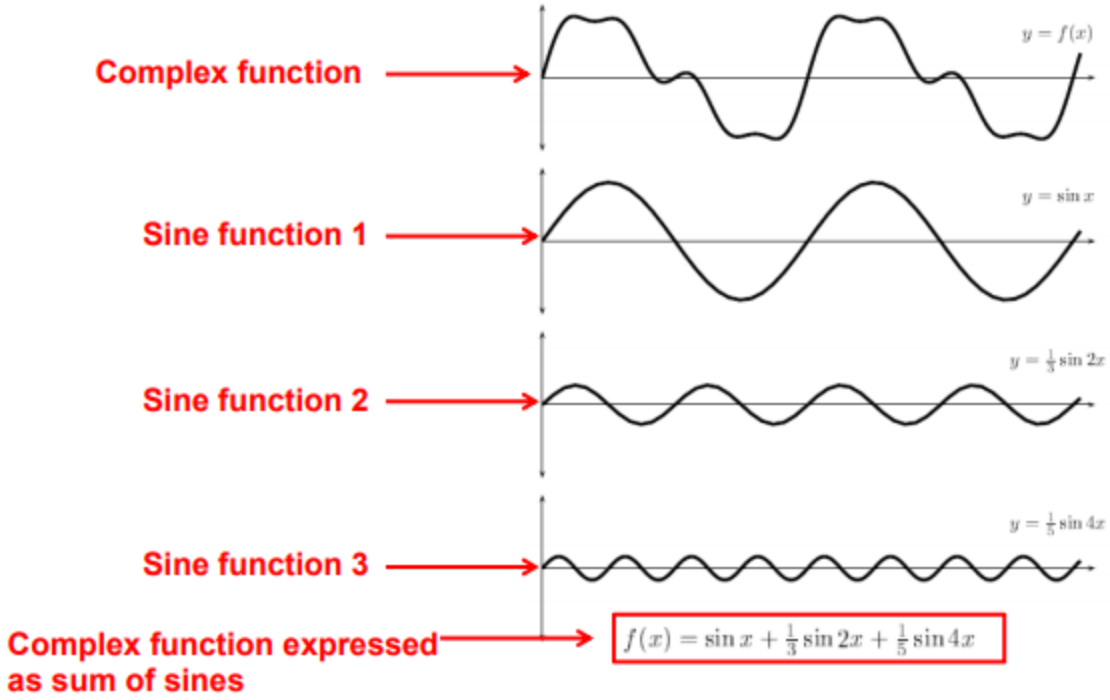
19EC351 – IMAGE PROCESSING AMD COMPUTER VISION



Guess Today's Topic????

Fourier Transform

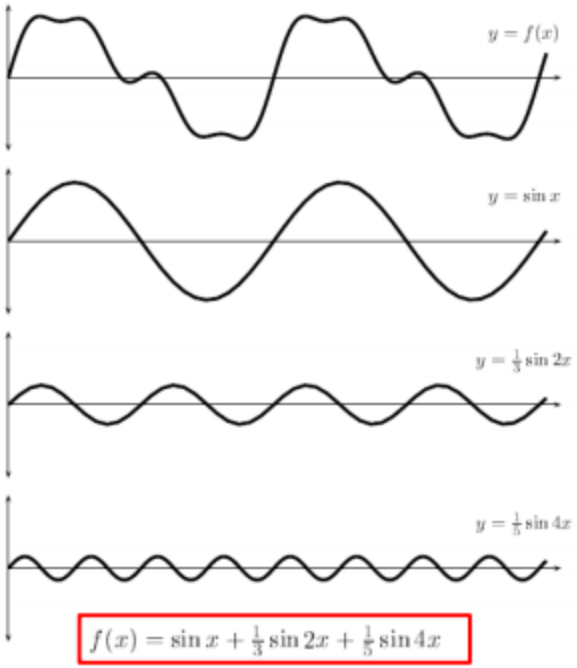
- **Main idea:** Any periodic function can be decomposed into a summation of sines and cosines



2D Discrete Fourier Transform

Fourier Transform: Why?

- Mathematially easier to analyze effects of transmission medium, noise, etc on simple sine functions, then add to get effect on complex signal



Property of 2D DFT

- Linearity $af(x,y)+bg(x,y) \Leftrightarrow aF(u,v)+bG(u,v)$
- Shifting $f(x-x_0,y-x_0) \Leftrightarrow e^{-j2\pi(ux_0+vy_0)}F(u,v)$
- Modulation $e^{j2\pi(u_0x+v_0y)}f(x,y) \Leftrightarrow F(u-u_0,v-v_0)$
- Convolution $f(x,y)*g(x,y) \Leftrightarrow F(u,v)G(u,v)$
- Multiplication $f(x,y)g(x,y) \Leftrightarrow F(u,v)*G(u,v)$
- Separability $f(x,y)=f(x)f(y) \Leftrightarrow F(u,v)=F(u)F(v)$

Discrete Cosine Transform

•The discrete cosine transform (DCT) helps separate the image into parts (or spectral sub-bands) of differing importance (with respect to the image's visual quality).

•The DCT is similar to the discrete Fourier transform: it transforms a signal or image from the spatial domain to the frequency domain.
The general equation for a 1D (*N data items) DCT is defined*

$$F(u) = \left(\frac{2}{N}\right)^{\frac{1}{2}} \sum_{i=0}^{N-1} \Lambda(i).cos\left[\frac{\pi.u}{2.N}(2i+1)\right] f(i)$$

Basic Operation of DCT

- The input image is N by M;
- f(i,j) is the intensity of the pixel in row i and column j;
- F(u,v) is the DCT coefficient in row k1 and column k2 of the DCT matrix.
- For most images, much of the signal energy lies at low frequencies; these appear in the upper left corner of the DCT.
- Compression is achieved since the lower right values represent higher frequencies, and are often small - small enough to be neglected with little visible distortion.
- The DCT input is an 8 by 8 array of integers. This array contains each pixel's gray scale level;
- 8 bit pixels have levels from 0 to 255.

Discrete Wavelet Transforms

There are many discrete wavelet transforms they are

- Coiflet,
- Daubechies,
- Haar,
- Symmlet

Haar Wavelet Transform

The Haar wavelet is the first known wavelet. The Haar wavelet is also the simplest possible wavelet. The Haar Wavelet can also be described as a step function f(x) shown in Eq

$$f(x) = \begin{cases} 1 & 0 \le x < 1/2, \\ -1 & 1/2 \le x < 1, \\ 0 & otherwise. \end{cases}$$

THANK YOU