Assignment 1

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BE comps C22

Q1 Explain Parsevals Energy Theorum.

→ Parsevals Energy theorum is a fundamental principle in signal processing and fourier analysis that relate total energy of signal in time domain to total energy of its representation in the frequency domain.

Definition.

It states that total energy of a signal is equal to tot energy of its fourier transform.

$$\int_{-\infty}^{\infty} |x(t)|^2 \, dt = \int_{-\infty}^{\infty} |X(f)^2| \, df.$$

Where.

$x(t)$ is time domain signal & $X(f)$ is its fourier transform.

Time domain energy is calculated as

$$E = \int_{-\infty}^{\infty} |x(t)|^2 \, dt.$$

The theorum illustrates the principle of energy conservation in signal indicating that regardless of whether the signal is analyzed in time or frequency domain the total energy remains invariant.

It aid in analyzing the distribution of energy such as audio compression

3 applications of DSP.

(1) Audio & speech processing
This involves manipulating sound signals to improve quality enable communication or extract meaningful information. DSP techniques are essential (1) filtering. (2) Speech recognition are some of the examples.

(2) Statistical signal processing.
This deals with analyzing and interpreting signals that are affected by noise and uncertainty. It uses statistical methods
(1) Estimation (2) Detection these help identify presence of signal amidst noise.

(3) Data compression.
This involves reducing amount of data required to represent a signal without significantly degrading quality.
(1) Transform coding (2) Lossless compression.

Write short notes on:

) Hotelling / KL transform
This is a statistical technique used for dimensionality reduction and feature extraction.
It involves for decomposition of a multivariate random process into orthogonal components.

ii) Moving average method for thresholding
This is used for thresholding. is determined based on average value.

iii) Iterative thresholding.
It is an adaptive thresholding technique used for image segmentation that adjusts threshold based on pixel intensities iteratively.

iv) Multivariate thresholding.
This is an extension of traditional thresholding. Instead of relying on a single intensity value this method utilizes multiple features.

v) JPEG compression algorithm.
Widely used lossy image compression technique that reduces file size while maintaining acceptable image quality. The image is converted from RGB to YCbCr. Each 8x8 block of pixels undergo DCT.