dct

Discrete cosine transform (DCT)

Syntax

```
y=dct(x)
y=dct(x,n)
```

Description

`y = dct(x)` returns the unitary discrete cosine transform of `x`

$$y(k) = w(k)\sum_{n=1}^{N} x(n)\cos\left(\frac{\pi(2n-1)(k-1)}{2N}\right) \quad k = 1,2,\ldots N$$

where

$$w(k) = \begin{cases} \dfrac{1}{\sqrt{N}} & k = 1 \\ \sqrt{\dfrac{2}{N}} & 2 \le k \le N \end{cases}$$

N is the length of `x`, and `x` and `y` are the same size. If `x` is a matrix, `dct` transforms its columns. The series is indexed from *n* = 1 and *k* = 1 instead of the usual *n* = 0 and *k* = 0 because MATLAB vectors run from 1 to *N* instead of from 0 to *N*- 1.

`y = dct(x,n)` pads or truncates `x` to length `n` before transforming.

The DCT is closely related to the discrete Fourier transform. You can often reconstruct a sequence very accurately from only a few DCT coefficients, a useful property for applications requiring data reduction.

Examples

Find how many DCT coefficients represent 99% of the energy in a sequence:

```
x = (1:100) + 50*cos((1:100)*2*pi/40);
X = dct(x);
[XX,ind] = sort(abs(X)); ind = fliplr(ind);
i = 1;
while (norm([X(ind(1:i)) zeros(1,100-i)])/norm(X)<.99)
   i = i + 1;
end
% i = 3
```

References

[1] Jain, A.K. *Fundamentals of Digital Image Processing,* Englewood Cliffs, NJ: Prentice-Hall, 1989.

[2] Pennebaker, W.B., and J.L. Mitchell. *JPEG Still Image Data Compression Standard,* New York, NY: Van Nostrand Reinhold, 1993. Chapter 4.

See Also

`fft`, `idct`, `dct2`, `idct2`