

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`

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

where

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

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](#)

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Yes

No

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