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

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

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:

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

References


See Also

fft, idct, dct2, idct2