Collective Table of Formulas

Discrete Fourier transforms (DFT) Pairs and Properties

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Discrete Fourier Transform Pairs and Properties (info)

Definition Discrete Fourier Transform and its Inverse

Let x[n] be a periodic DT signal, with period N.

N-point Discrete Fourier Transform $X[k] = \sum_{n=0}^{N-1} x[n] e^{-j2\pi \frac{kn}{N}}$

Inverse Discrete Fourier Transform $x[n] = (1/N) \sum_{k=0}^{N-1} X[k] e^{j2\pi \frac{kn}{N}}$

Discrete Fourier Transform Pairs (info)

$x[n]$ (period N)	$\longrightarrow X_N[k]$ (N point DFT)
$\sum_{k=-\infty}^{\infty} \delta[n+Nk] = \begin{cases} 1, & \text{if } n = 0, \pm N, \pm 2N, \dots \\ 0, & \text{else.} \end{cases}$	1 (period N)
1 (period N)	$N \sum_{m=-\infty}^{\infty} \delta[k+Nm] = \begin{cases} N, & \text{if } n = 0, \pm N, \pm 2N, \dots \\ 0, & \text{else.} \end{cases}$
$e^{j2\pi k_0 n}$	$N\delta[((k-k_0))_N]$
$\cos(\frac{2\pi}{N} k_0 n)$	$\frac{N}{2}(\delta[((k-k_0))_N] + \delta[((k+k_0))_N])$

Discrete Fourier Transform Properties

	$x[n]$	$\longrightarrow X[k]$
Linearity	$ax[n] + by[n]$	$aX[k] + bY[k]$
Circular Shift	$x[((n-m))_N]$	$X[k]e^{(-j\frac{2\pi}{N}km)}$
Duality	$X[n]$	$NX[((-k))_N]$
Multiplication	$x[n]y[n]$	$\frac{1}{N} X[k] \circledast Y[k]$, $\circledast$ denotes the circular convolution
Convolution	$x(t) \circledast y(t)$	$X[k]Y[k]$
	$x^*[n]$	$X^*[((-k))_N]$
	$x^*[((-n))_N]$	$X^*[k]$
	$\mathrm{R}\{x[n]\}$	$X_{ep}[k] = \frac{1}{2}\{X[((k))_N] + X^*[((-k))_N]\}$
	$j\mathrm{I}\{x[n]\}$	$X_{op}[k] = \frac{1}{2}\{X[((k))_N] - X^*[((-k))_N]\}$
	$x_{ep}[n] = \frac{1}{2}\{x[n] + x^*[((-n))_N]\}$	$\mathrm{R}\{X[k]\}$
	$x_{op}[n] = \frac{1}{2}\{x[n] - x^*[((-n))_N]\}$	$j\mathrm{I}\{X[k]\}$

Other Discrete Fourier Transform Properties

Parseval's Theorem $\sum_{n=0}^{N-1} |x[n]|^2 = \frac{1}{N} \sum_{k=0}^{N-1} |X[k]|^2$

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