Transform Table

	Time	Frequency
Laplace Transform (LT) ω continuous and aperiodic t continuous and aperiodic	$x(t) = \frac{1}{2\pi i}\int_{-\infty}^{\infty} X(\omega).e^{(\gamma - j\omega)t} d\omega$	$X(s) = \int_0^{\infty} x(t) e^{-st} dt$
Fourier Transform (FT) ω continuous and aperiodic t continuous and aperiodic	$x(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} X(\omega) e^{jwt} d\omega$	$X(\omega) = \int_{-\infty}^{\infty} x(t) e^{-jwt} dt$
Fourier Series (FS) $\omega(k)$ discrete and aperiodic t discrete and periodic	$x(t) = \sum_{k=-\infty}^{\infty} c_k e^{jkt}$	$c_k = \frac{1}{2\pi}\int_0^{2\pi} x(t) e^{-jkt} dt$
Discrete Time FT (DTFT) k (frequency) continuous and periodic n (time) discrete and aperiodic	$x[n] = \frac{1}{2\pi}\int_0^{2\pi} X(\omega) e^{j\omega N} d\omega$	$X(k) = \sum_{n=-\infty}^{\infty} x[n] e^{-j\omega n}$
Discrete Fourier Transform (DFT) **"Typical" way** k (frequency) discrete and periodic n (time) discrete and periodic	$x[n] = \frac{1}{N}\sum_{k=0}^{N-1} X(k) e^{j\frac{2\pi nk}{N}}$	$X(k) = \sum_{n=0}^{N-1} x[n] e^{-j\frac{2\pi nk}{N}}$
Discrete Fourier Transform (DFT) **"Ljung" way** ω (frequency) discrete on the interval $(-\pi, \pi)$, and ω is 2π-periodic n (time) discrete $\{1, \ldots, N\}$and periodic	$x[n] = \frac{1}{\sqrt{N}}\sum_{k=1}^{N} X(\frac{2\pi k}{N}) e^{j\frac{2\pi nk}{N}}$	$X(\omega) = \frac{1}{\sqrt{N}}\sum_{n=1}^{N} x[n] e^{-j\omega n}$

Some DFT Properties ("Standard" – will update)

Time	Property	Frequency
$x(n-m)$	Time Shift	$X(k)e^{-j\frac{2\pi m}{N}}$
$a.x[n]+b.y[n]$	Linearity	$a.X(k)+b.Y(k)$
$x[-n]=x[N-n]$	Time Reverse	$X(-k)=X(N-k)$
$x^*[n]$	Conjugation	$X^*(-k)=X^*(N-k)$
$x[n-rN]$[1] $=x[n]$	Periodicity	$X(k-rN)=X(k)$
$x[n]\circledast h[n]$	Convolution	$X(k)H(k)$
$x[n]y[n]$	Multiplication	$\frac{1}{N}X(k)*Y(k)$ [1]
$\sum_{n=0}^{N-1}\lvert x[n]\rvert^2$	Parseval	$\frac{1}{N}\sum_{n=0}^{N-1}\lvert X(k)\rvert^2$

Some DFT Results

$DFT_N[\delta[n]]$	1
$DFT_N[1]$	$N\delta(k)$
$DFT_N\left(e^{j\frac{2\pi r}{N}}\right)$	$N\delta(k-r)$
$DFT_N[\cos\left(\frac{2\pi r}{N}\right)]$	$\frac{N}{2}\delta(k-r)+\frac{N}{2}\delta(N-k-r)$
$DFT_N[\sin\left(\frac{2\pi r}{N}\right)]$	$\frac{N}{2j}\delta(k-r)+\frac{N}{2j}\delta(N-k-r)$

[1] For r an integer value