

## z-TRANSFORM PROPERTIES

The index-domain signal is  $x[n]$  for  $-\infty < n < \infty$ ; and the  $z$ -transform is:

$$X(z) = \sum_{n=-\infty}^{\infty} x[n] z^{-n} \iff x[n] = \frac{1}{2\pi j} \oint X(z) z^n \frac{dz}{z}$$

The ROC is the set of complex numbers  $z$  where the  $z$ -transform sum converges.

Signal: $x[n] \quad -\infty < n < \infty$	$z$ -Transform: $X(z)$	Region of Convergence
$x[n], x_1[n]$ and $x_2[n]$	$X(z), X_1(z)$ and $X_2(z)$	$R_x, R_1$ and $R_2$
$ax_1[n] + bx_2[n]$	$aX_1(z) + bX_2(z)$	contains $R_1 \cap R_2$
$x[n - n_0]$	$z^{-n_0} X(z)$	$R_x$ except for the possible addition or deletion of $z = 0$ or $z = \infty$
$z_0^n x[n]$	$X(z/z_0)$	$ z_0  R_x$
$n x[n]$	$-z \frac{dX(z)}{dz}$	$R_x$ except for the possible addition or deletion of $z = 0$ or $z = \infty$
$x^*[n]$	$X^*(z^*)$	$R_x$
$\Re\{x[n]\}$	$\frac{1}{2}[X(z) + X^*(z^*)]$	contains $R_x$
$\Im\{x[n]\}$	$\frac{1}{2j}[X(z) - X^*(z^*)]$	contains $R_x$
$x[-n]$	$X(1/z)$	$1/R_x = \{z : z^{-1} \in R_x\}$
$x_1[n] * x_2[n]$	$X_1(z) \cdot X_2(z)$	contains $R_1 \cap R_2$
$x_1[n] \cdot x_2[n]$	$\frac{1}{2\pi j} \oint X_1(v) X_2(z/v) \frac{dv}{v}$	contains $R_1 R_2$

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