EL3005: Señales y Sistemas I

I.5 Transformada de Fourier a Tiempo Discreto

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Ilustración del Fenómeno de Gibbs

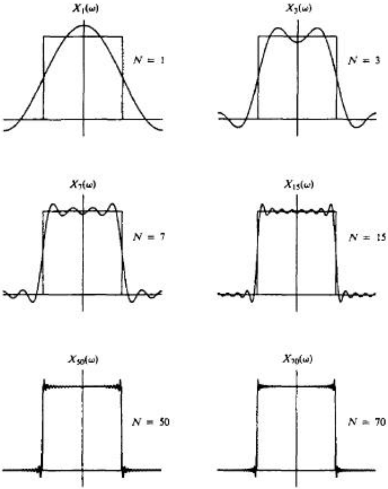
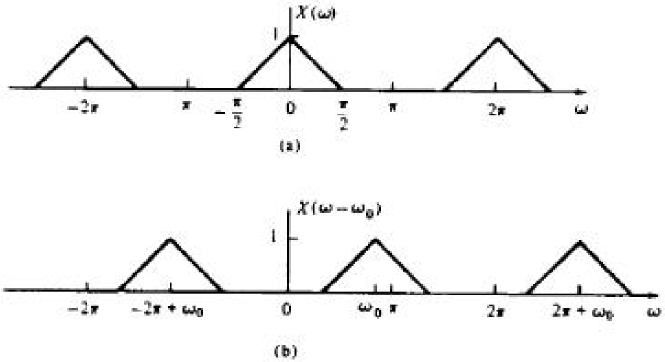
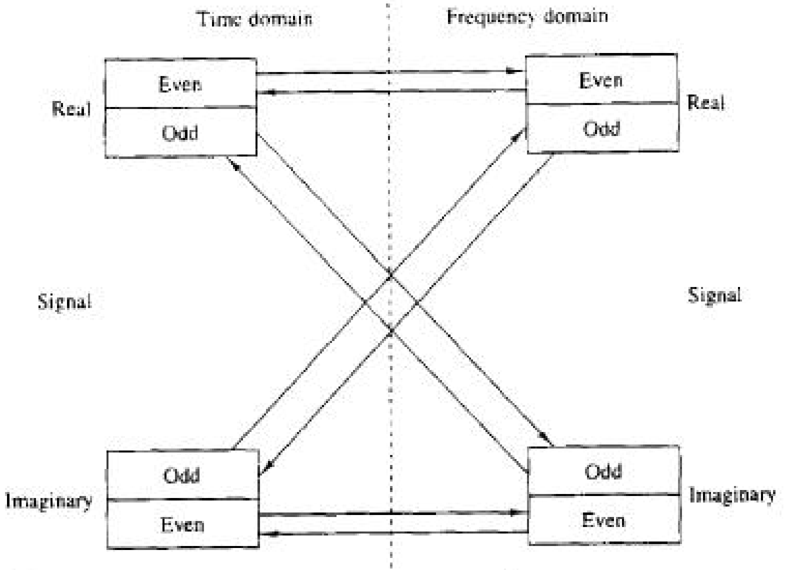


Ilustración de la Modulación en Frecuencia



Resumen de Propiedades de Simetría de la DTFT



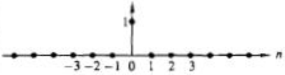
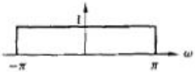
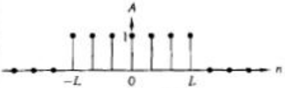
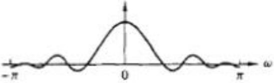
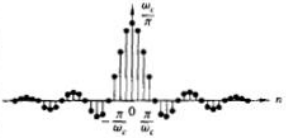
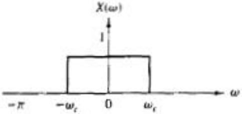
Resumen de Propiedades de la DTFT

TABLE 4.5 PROPERTIES OF THE FOURIER TRANSFORM FOR DISCRETE-TIME SIGNALS

Property	Time Domain	Frequency Domain
Notation	$x(n)$	$X(\omega)$
	$x_1(n)$	$X_1(\omega)$
	$x_2(n)$	$X_2(\omega)$
Linearity	$a_1x_1(n)+a_2x_2(n)$	$a_1X_1(\omega)+a_2X_2(\omega)$
Time shifting	$x(n-k)$	$e^{-j\omega k}X(\omega)$
Time reversal	$x(-n)$	$X(-\omega)$
Convolution	$x_1(n)*x_2(n)$	$X_1(\omega)X_2(\omega)$
Correlation	$r_{x_1x_2}(l)=x_1(l)*x_2(-l)$	$S_{x_1x_2}(\omega)=X_1(\omega)X_2(-\omega)$ $=X_1(\omega)X_2^*(\omega)$ [if $x_2(n)$ is real]
Wiener–Khintchine theorem	$r_{xx}(l)$	$S_{xx}(\omega)$
Frequency shifting	$e^{j\omega_0 n}x(n)$	$X(\omega-\omega_0)$
Modulation	$x(n)\cos\omega_0 n$	$\frac{1}{2}X(\omega+\omega_0)+\frac{1}{2}X(\omega-\omega_0)$
Multiplication	$x_1(n)x_2(n)$	$\frac{1}{2\pi}\int_{-\pi}^{\pi}X_1(\lambda)X_2(\omega-\lambda)d\lambda$
Differentiation in the frequency domain	$nx(n)$	$j\frac{dX(\omega)}{d\omega}$
Conjugation	$x^*(n)$	$X^*(-\omega)$
Parseval's theorem	$\sum_{n=-\infty}^{\infty}x_1(n)x_2^*(n)=\frac{1}{2\pi}\int_{-\pi}^{\pi}X_1(\omega)X_2^*(\omega)d\omega$	

Transformadas útiles

TABLE 4.6 SOME USEFUL FOURIER TRANSFORM PAIRS FOR DISCRETE-TIME APERIODIC SIGNALS

Signal $x(n)$	Spectrum $X(\omega)$
 $x(n) = \delta(n)$	 $X(\omega) = 1$
 $x(n) = \begin{cases} A, & \lvert n\rvert \le L \\ 0, & \lvert n\rvert > L \end{cases}$	 $X(\omega) = A\dfrac{\sin\left(L+\frac{1}{2}\right)\omega}{\sin\frac{\omega}{2}}$
 $x(n) = \begin{cases} \dfrac{\omega_c}{\pi}, & n = 0 \\ \dfrac{\sin \omega_c n}{\pi n}, & n \ne 0 \end{cases}$	 $X(\omega) = \begin{cases} 1, & \lvert\omega\rvert < \omega_c \\ 0, & \omega_c \le \lvert\omega\rvert \le \pi \end{cases}$