Fourier Dönüşümü Özellikleri
Kaynak: *Bilgisayar Uygulamalarıyla Sayısal İşaret İşleme*, Ahmet H. Kayran ve Ender M. Ekşioğlu, Birsen Yayınevi, 2004.

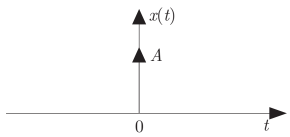
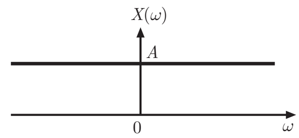
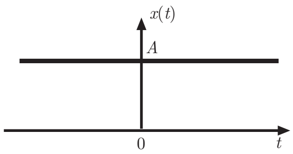
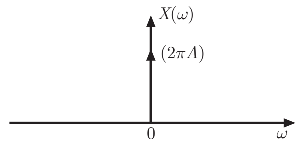
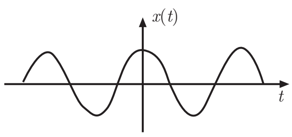
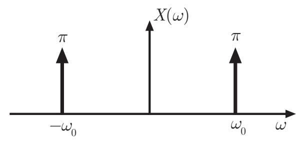
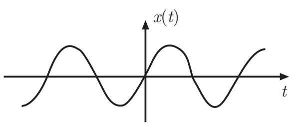
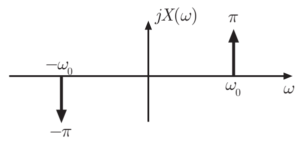
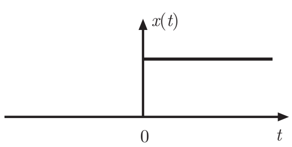
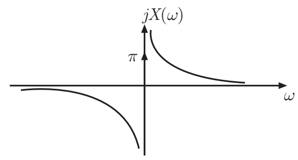
Tablo 1 Fourier Dönüşümü (İntegrali) Özellikleri

1	Doğrusallık	$\mathscr{F}[ax(t)+by(t)] = aX(\omega)+bY(\omega)$
2	Frekans kaydırma	$\mathscr{F}[x(t)e^{j\omega_0 t}] = X(\omega-\omega_0)$
3	Zaman kaydırma	$\mathscr{F}[x(t-t_0)] = X(\omega)e^{-j\omega t_0}$
4	Zaman türevi	$\mathscr{F}[\frac{dx(t)}{dt}] = j\omega X(\omega)$
5	Zaman integrali	$\mathscr{F}[\int_{-\infty}^{t} x(\tau)d\tau] = \frac{X(\omega)}{j\omega} + \pi X(0)\delta(\omega)$
6	Zaman domeninde konvolüsyon	$\mathscr{F}[x(t)*y(t)] = X(\omega)Y(\omega)$ $x(t)*y(t) \triangleq \int_{-\infty}^{\infty} x(\tau)y(t-\tau)d\tau$
7	Frekans domeninde konvolüsyon	$\mathscr{F}[X(\omega)*Y(\omega)] = x(t)y(t)$ $X(\omega)*Y(\omega) \triangleq \int_{-\infty}^{\infty} X(\alpha)Y(\omega-\alpha)d\alpha$
8	Ölçekleme	$\mathscr{F}[x(at)] = \frac{1}{\lvert a\rvert}X(\frac{\omega}{a})$; gerçel a için

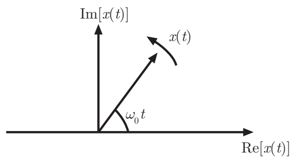
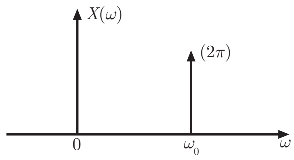
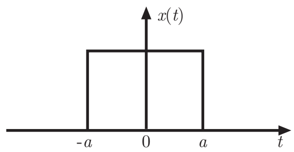
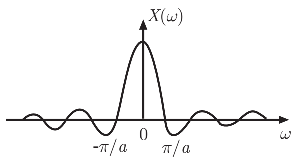
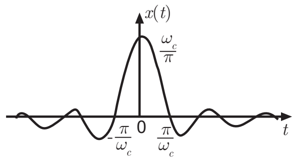
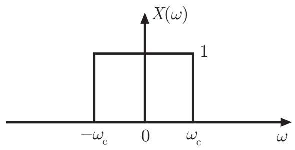
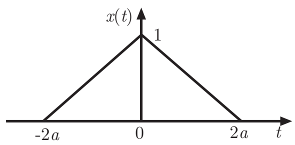
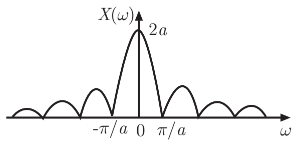
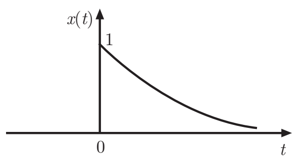
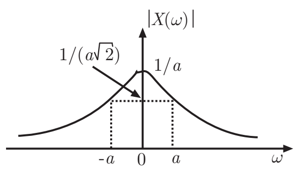
Tablo 1 (devam)

9	Parseval Teoremi	$\int_{-\infty}^{\infty} \lvert x(t)\rvert^2 dt = \frac{1}{2\pi}\int_{-\infty}^{\infty} \lvert X(\omega)\rvert^2 d\omega$
10	Dualite (Zaman-Frekans)	$\mathscr{F}[X(t)] = 2\pi x(-\omega)$
11	Korelasyon	$\mathscr{F}[\int_{-\infty}^{\infty} x(t)y(t+\tau)dt] =$ $\mathscr{F}[x(t) * y(-t)] = X(\omega)Y^*(\omega)$
12	Karmaşık eşlenik	$\mathscr{F}[x^*(t)] = X^*(-\omega)$
13	Genlik modülasyonu	$\mathscr{F}[x(t)\cos\omega_0 t] = \frac{1}{2}X(\omega+\omega_0) + \frac{1}{2}X(\omega-\omega_0)$
14	Simetri (Çift-Tek)	$\mathscr{F}[x_{\text{çift}}(t)] = X_{\text{çift}}(\omega)$ $\mathscr{F}[x_{\text{tek}}(t)] = X_{\text{tek}}(\omega)$
15	Frekans türevi	$\mathscr{F}[tx(t)] = j\frac{dX(\omega)}{d\omega}$
16	Gerçel $x(t)$	$X(\omega) = X^*(-\omega)$ $Re[X(\omega)] = Re[X(-\omega)]$ $Im[X(\omega)] = -Im[X(-\omega)]$ $\lvert X(\omega)\rvert = \lvert X(-\omega)\rvert$ $\angle X(\omega) = -\angle X(-\omega)$

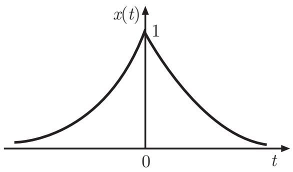
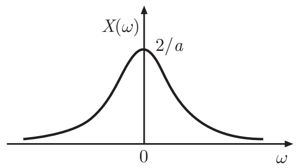
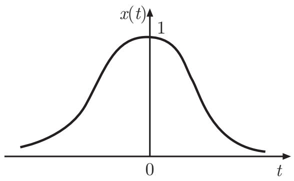
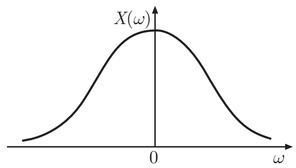
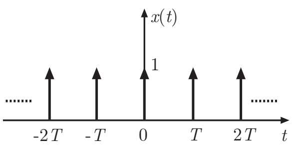
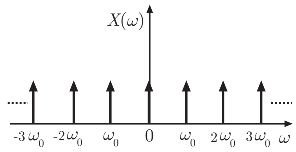
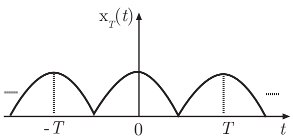
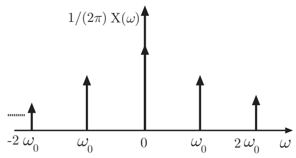
Tablo 2 Bazı önemli Fourier dönüşümleri

1	İmpuls	 $x(t) = A\delta(t)$	 $X(\omega) = A$
2	Sabit	 $x(t) = A$	 $X(\omega) = 2\pi A\delta(\omega)$
3	Kosinüs	 $x(t) = \cos(\omega_0 t)$	 $X(\omega) = \pi\big(\delta(\omega-\omega_0)+\delta(\omega+\omega_0)\big)$
4	Sinüs	 $x(t) = \sin(\omega_0 t)$	 $X(\omega) = j\pi\big(\delta(\omega+\omega_0)-\delta(\omega-\omega_0)\big)$
5	Basamak	 $x(t) = u(t) = \int_{-\infty}^{t}\delta(\tau)d\tau$	 $X(\omega) = \pi\delta(\omega) + \frac{1}{j\omega}$

Kaynak: Bilgisayar Uygulamalarıyla Sayısal İşaret İşleme, Ahmet H. Kayran ve Ender M. Ekşioğlu, Birsen Yayınevi, 2004.

<table>
<tr><td>6</td><td>Kompleks üstel</td><td>$x(t) = e^{j\omega_0 t}$</td><td>$X(\omega) = 2\pi\delta(\omega - \omega_0)$</td></tr>
<tr><td>7</td><td>Darbe</td><td>$x(t) = u(t+a) - u(t-a)$</td><td>$X(\omega) = 2a\dfrac{\sin(\omega a)}{\omega a}$</td></tr>
<tr><td>8</td><td>Sınırlı Bantlı İşaret</td><td>$x(t) = \dfrac{\omega_c}{\pi}\dfrac{\sin(\omega_c t)}{\omega_c t}$</td><td>$X(\omega) = u(\omega + \omega_c) - u(\omega - \omega_c)$</td></tr>
<tr><td>9</td><td>Üçgen</td><td>$x(t) = 1 - \dfrac{1}{2a}|t|;\ |t| < 2a$</td><td>$X(\omega) = 2a\dfrac{\sin^2(\omega a)}{(\omega a)^2}$</td></tr>
<tr><td>10</td><td>Tek-taraflı üstel işaret</td><td>$x(t) = e^{-at}u(t);\ a > 0$</td><td>$X(\omega) = \dfrac{1}{a + j\omega}$</td></tr>
</table>

Kaynak: Bilgisayar Uygulamalarıyla Sayısal İşaret İşleme, Ahmet H. Kayran ve Ender M. Ekşioğlu, Birsen Yayınevi, 2004.

11	İki-taraflı üstel işaret	 $x(t) = e^{-a\|t\|};\ a > 0$	 $X(\omega) = \dfrac{2a}{\omega^2 + a^2}$
12	Gauss işareti	 $x(t) = e^{-at^2}$	 $X(\omega) = \sqrt{\dfrac{\pi}{a}}e^{\omega^2 4a}$
13	İmpuls treni	 $x(t) = x_T(t)$ $= \sum_{n=-\infty}^{\infty} \delta(t - nT)$ Fourier Serisi	 $X(\omega) = \dfrac{2\pi}{T} \sum_{k=-\infty}^{\infty} \delta(\omega - k\omega_0)$ $\omega_0 \equiv 2\pi/T$
14	Periyodik işaret	 $x_T(t) = x_T(T + t)$ $= \sum_{k=-\infty}^{\infty} X_k e^{jk\omega_0 t}$ X_k:Fourier Serisi Katsayıları	 $X(\omega) = 2\pi \sum_{k=-\infty}^{\infty} X_k \delta(\omega - k\omega_0)$ $\omega_0 \equiv 2\pi/T$

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