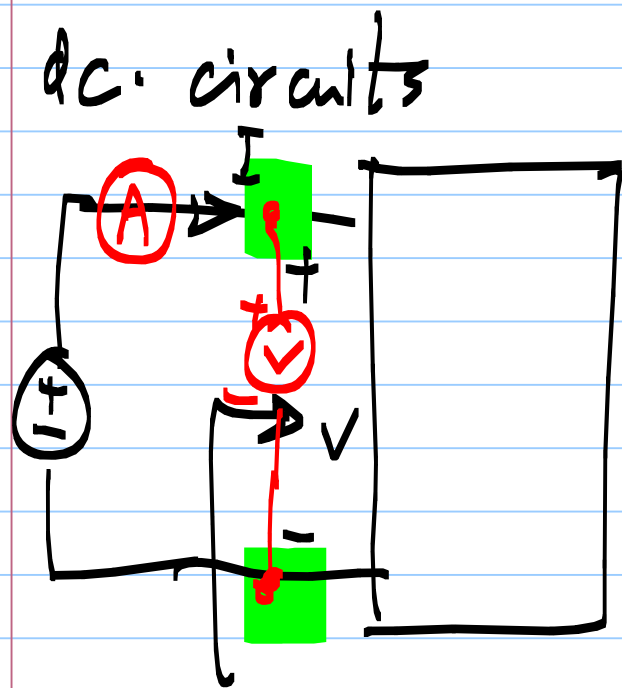
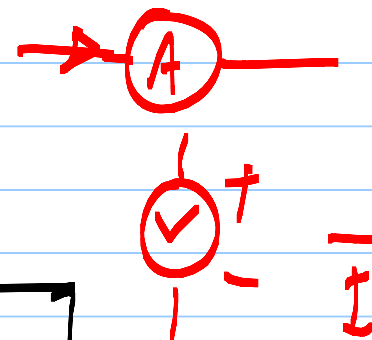
EE 2015

3/11/2017

dc circuits



$V \cdot I$

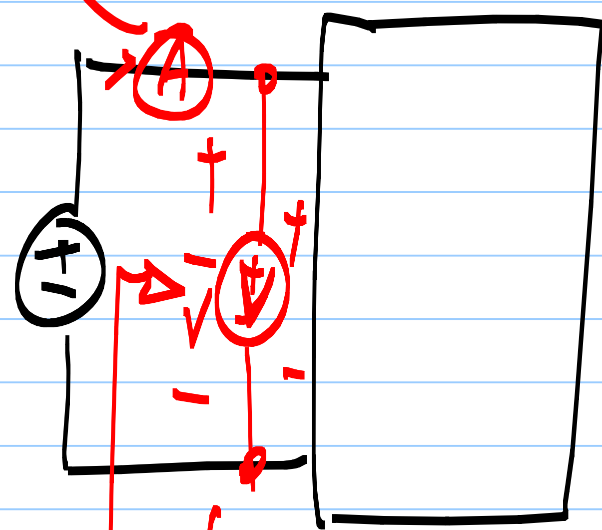


$$\frac{V_p I_p \cos(\phi)}{2}$$

$$Re\left(\frac{\bar{V}\bar{I}^*}{2}\right)$$

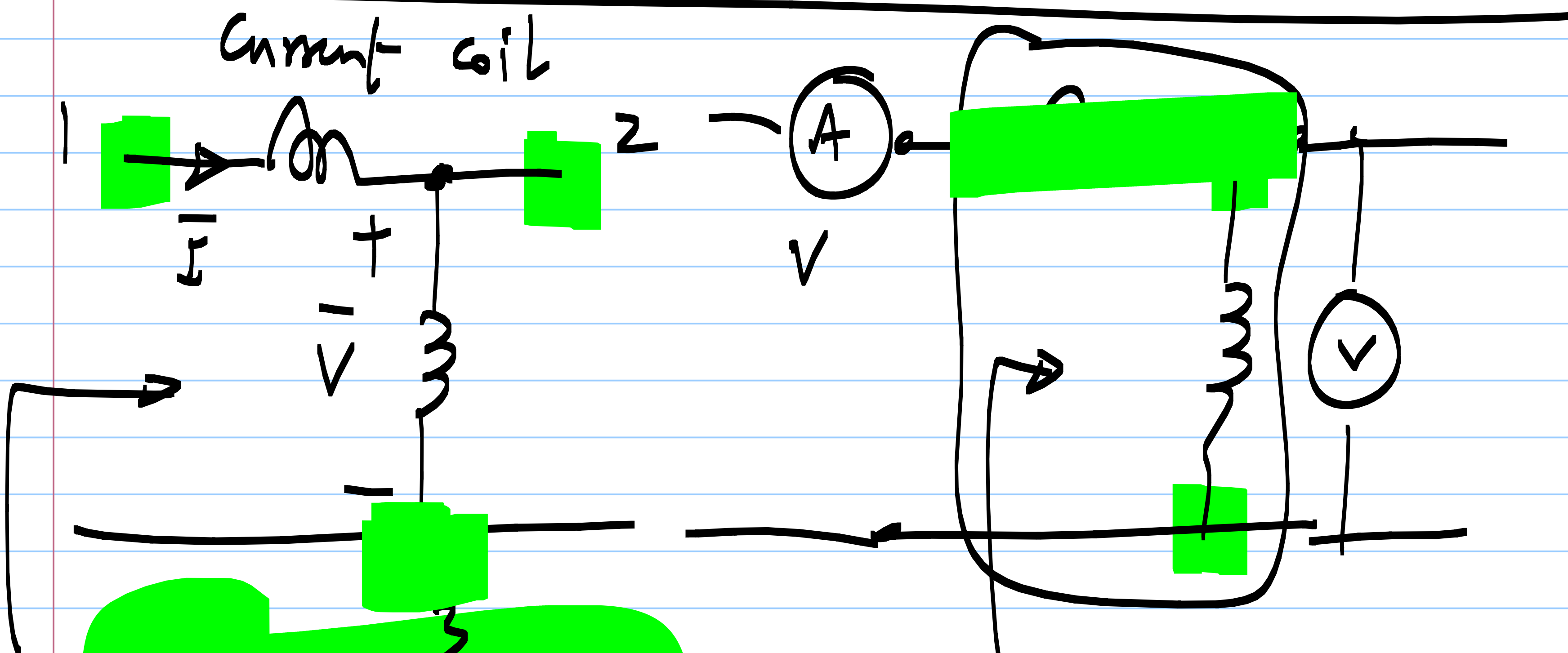
A · rms

ac circuits (50Hz
ac power

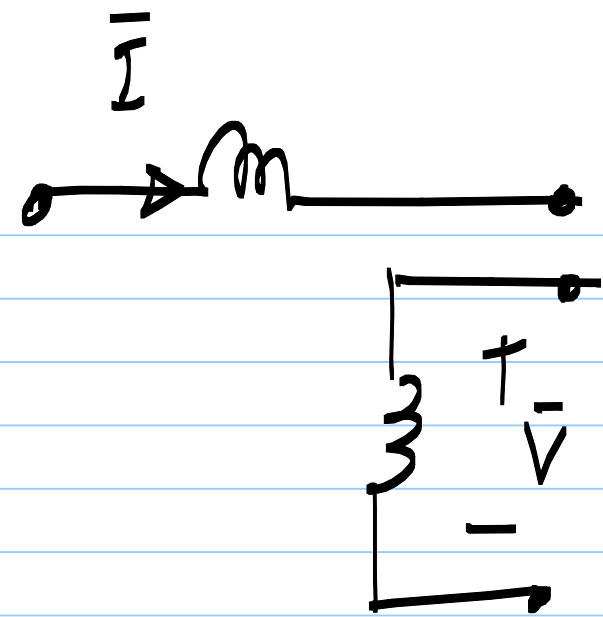


V · rms

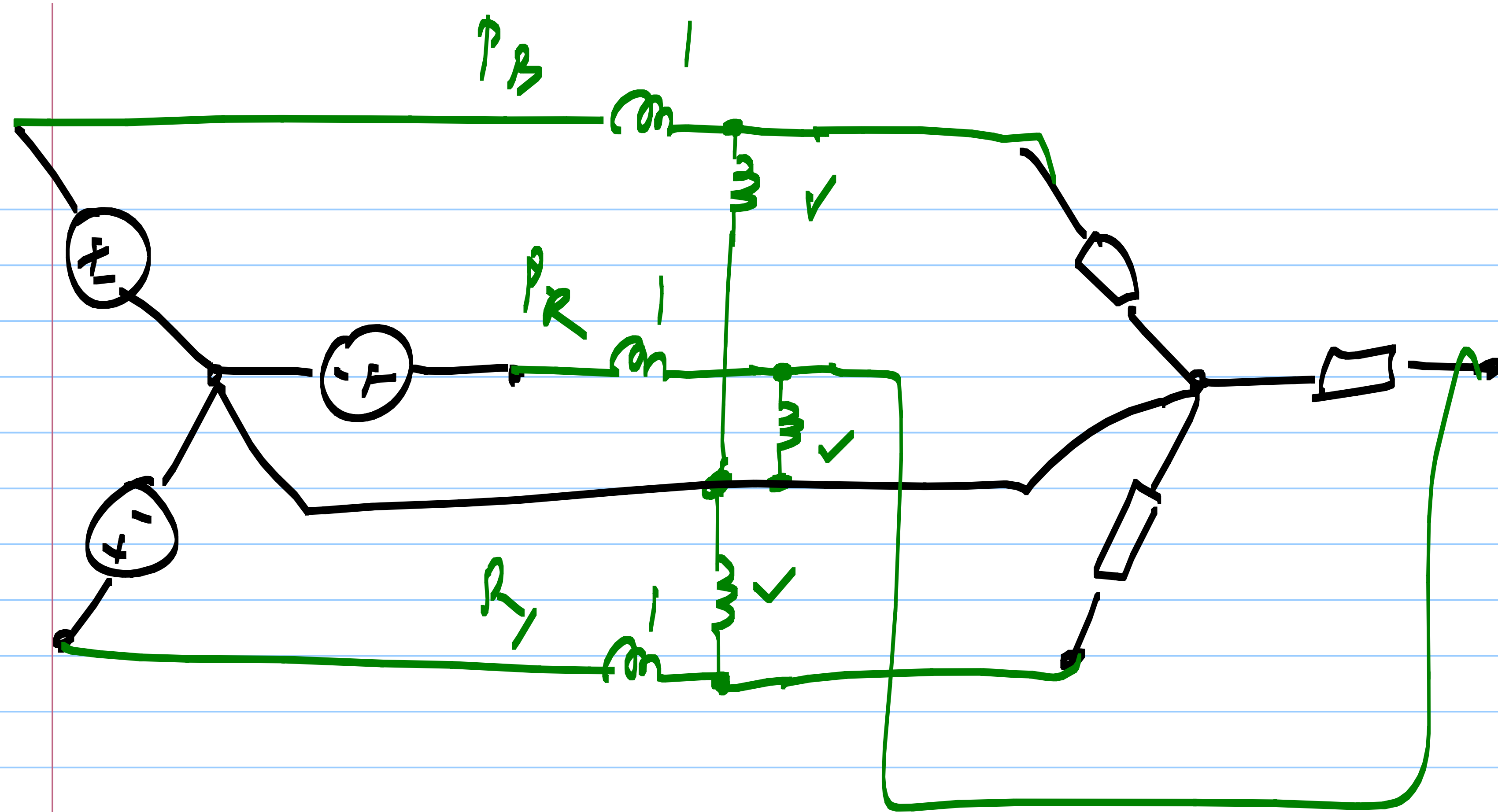
Wattmeter (for ac power measurement)



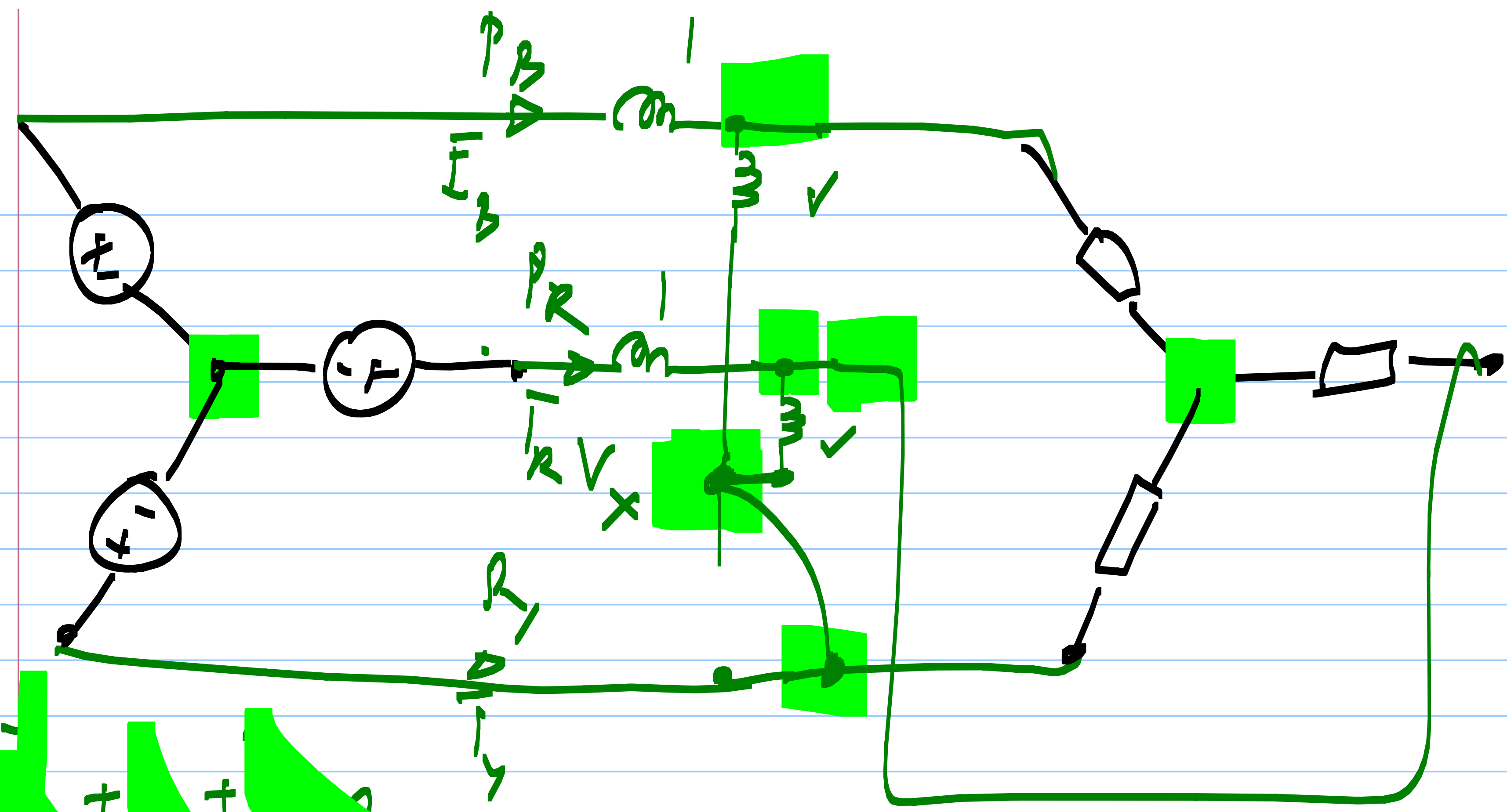
$$\mathrm{Re}\left(\frac{\bar{V}\bar{I}^*}{2}\right)$$ computes the avg. power



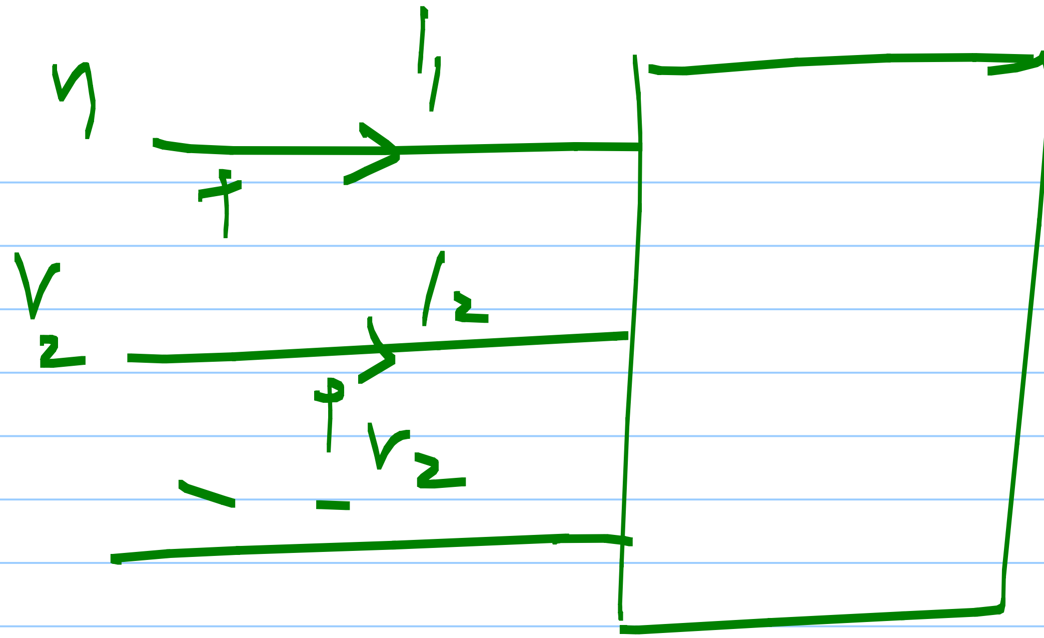
$\bar{I}$
+
$\bar{V}$
−

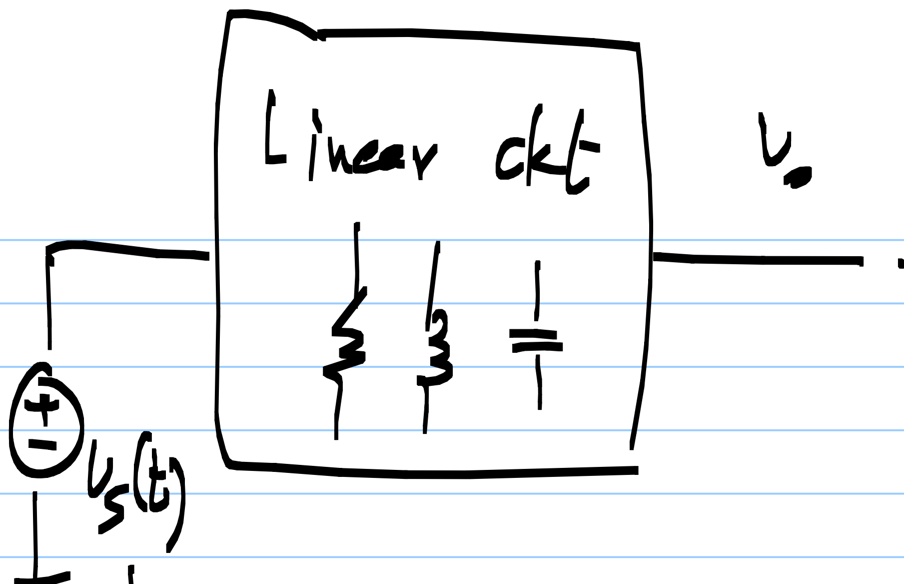


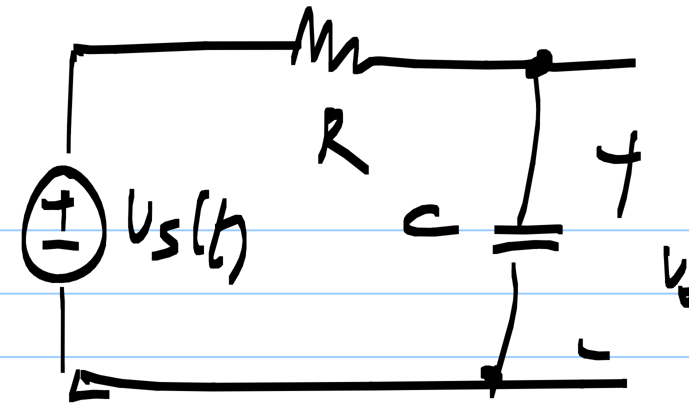
$$P_{tot} = P_R + P_Y + P_B$$



$\bar{V}_x - \bar{V}_x$, $\bar{V}_y - \bar{V}_x$,


η
l_1
+
ν_2
l_2
+
ν_2





exp$(j\omega t)$

steady-state v_o : $H(j\omega) \cdot \exp(j\omega t)$

Total response

- Natural / steady-state
- Transient / Forced
- Zero-input / Zero-state

Representing an arbitrary signal $x(t)$ in terms of complex exponentials

Periodic $x(t) = \sum_{k=-\infty}^{\infty} a_k \exp(j \cdot 2\pi k f_0 t)$

Period $= T_0$

$\underbrace{f_0 = 1/T_0}_{\text{fund. freq.}}$

Fourier Series

$$= a_0 + \sum_{k=1}^{\infty} b_k \cos(2\pi k f_0 t) + c_k \sin(2\pi k f_0 t)$$

$$= a_0 + \sum_{k=1}^{\infty} d_k \cos(2\pi k f_0 t + \phi_k)$$

$x(t)$ is not periodic :

$$x(t) = \int_{-\infty}^{\infty} X_f(f) \underbrace{\exp(j \overbrace{2\pi f}^{\omega = 2\pi f} t)} \cdot df$$

(v)

$X_f(f)$: Fourier transform of $x(t)$

freq. in Hz

$$X_f(f) = \int_{-\infty}^{\infty} x(t) \cdot \exp(-j 2\pi f t) \cdot dt$$

$$X_\omega(\omega) = X_f\left(\frac{\omega}{2\pi}\right)$$

$$x(t) = \frac{1}{2\pi}\int_{\infty}^{\infty} X_\omega(\omega) \cdot \exp(j\omega t) \cdot d\omega$$

$$X_\omega(\omega) = \int_{-\infty}^{\infty} \underbrace{x(t) \exp(-j\omega t) \cdot dt}$$

$$X_{j\omega}(j\omega) = X_{\omega}(\omega)$$

$$x(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} X_{\omega}(\omega) \exp(j\omega t) \cdot d\omega$$

$$= \frac{1}{j2\pi} \int X_{j\omega}(j\omega) \exp(j\omega t)\, d(j\omega)$$

$x(t)$	$X_f(f)$	$X_\omega(\omega)$
1	$\delta(f)$	$2\pi\delta(\omega)$
$\cos(\omega_0 t)$	$\frac{1}{2}\delta(f-f_0)+\frac{1}{2}\delta(f+f_0)$	$\pi\delta(\omega-\omega_0)+\pi\delta(\omega+\omega_0)$
$\exp(j\omega_0 t)$	$\delta(f-f_0)$	$2\pi\delta(\omega-\omega_0)$
$\sin(\omega_0 t)$	$\frac{1}{2j}\delta(f-f_0)-\frac{1}{j2}\delta(f+f_0)$	$\frac{\pi}{j}(\delta(\omega-\omega_0)-\delta(\omega+\omega_0))$
$\exp(-a\|t\|)$		