El-Problem 6. Properties of Fourier Transform of real-valued signals Let x() be a real-valued signal.

Let $x(\cdot)$ be a real-value signar.

(a) If $x(\cdot)$ is odd (i.e. x(-t)=-x(t)), show that $\hat{x}(-)$ is pure imaginary and odd $\hat{x}(t)=\int_{0}^{\infty}a_{x}(t)e^{j2\pi ft}\,dt=\int_{0}^{\infty}x(t)e^{j2\pi ft}\,dt+\int_{0}^{\infty}x(t)e^{j2\pi ft}\,dt=\int_{0}^{\infty}x(t)e^{j2\pi f(-t)}\,dt+\int_{0}^{\infty}x(t)e^{j2\pi f(-t)$

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 $= + \int_{\infty}^{0} x(t) e^{\pm j2nft} dt + \int_{0}^{\infty} x(t) e^{\pm j2nft} dt = -\int_{0}^{\infty} x(t) e^{j2nft} dt = -\int_{0}^{\infty} x(t) e^{j2nft} dt = -\int_{0}^{\infty} x(t) e^{j2nft} dt = -\int_{0}^{\infty} x(t) e^{-j2nft} dt = -\int_{0}^{\infty} x(t) e^{-j2nft}$

 $\hat{x}(f) \int_{0}^{\infty} x(t) e^{ij2\pi ft} dt = \int_{0}^{\infty} x(t) \left(\cos(2\pi ft) - i\sin(2\pi ft)\right) dt = \int_{0}^{\infty} x(t) e^{ij2\pi ft} dt = \int_{0}^{\infty} x(t) \left(\cos(2\pi ft) - i\sin(2\pi ft)\right) dt = \int_{0}^{\infty} x(t) e^{ij2\pi ft} dt$

= $\int_{\infty}^{\infty} x(t) \cos(2\pi ft) dt + \int_{\infty}^{\infty} (t) \cos(2\pi ft) dt = \int_{\infty}^{\infty} x(t) \sin(2\pi ft) dt = \int_{\infty}^{\infty} x(t) \cos(2\pi ft) dt = \int_{\infty}^{\infty} x(t) dt = \int_{\infty}^{\infty} x(t) \cos(2\pi ft) dt = \int_{\infty}^{\infty} x(t) dt = \int_{$

= \int x(-t) cos(2nf(-t)) dt + \int x(t) cos(2nft) dt-j \int x(-t) sin (2nf(-t)) dx -j \int x(t) sin (2nft) dt =

= $-\int_{0}^{\infty} x(t) \cos(2\pi ft) dt + \int_{0}^{\infty} x(t) \cos(2\pi ft) dt = \int_{0}^{\infty} x(t) \sin(2\pi ft) - \int_{0}^{\infty} x(t) \sin(2\pi ft) dt =$

= -j2 $\int x(t) \sin(2ntt) dt$ $\in \{0+iy\} \Rightarrow \hat{x}(\cdot)$ is purely imaginary integral of real functions