

Tutorial 5 on Week 6

1. Compute the Fourier transform of

$$x(t) = e^{-\alpha|t|}, \quad \alpha > 0$$

Then find the magnitude and phase of $X(j\Omega)$.

2. Compute the Fourier transform of $x(t) = \cos(100t)$.
3. Compute the Fourier transform of $x(t) = 1$.
4. Compute the Fourier transform of

$$x(t) = \sum_{k=0}^{\infty} \alpha^k \delta(t - kT), \quad |\alpha| < 1$$

5. Prove the conjugation property of Fourier transform:

$$x(t) \leftrightarrow X(j\Omega) \Rightarrow x^*(t) \leftrightarrow X^*(-j\Omega)$$

Then show that if $x(t)$ is real-valued, then the magnitude of Fourier transform is symmetric around $\Omega = 0$:

$$|X(j\Omega)| = |X(-j\Omega)|$$

6. Prove the frequency shifting property of Fourier transform:

$$x(t) \leftrightarrow X(j\Omega) \Rightarrow e^{j\Omega_0 t} x(t) \leftrightarrow X(j(\Omega - \Omega_0))$$

Then determine the Fourier transform of $x(t) \cos(\Omega_0 t)$ in terms of $X(j\Omega)$.