Friday, 6 Nov 2020.

1. **Fourier transform of basic signals**

   Find the Fourier transform of each of the following signals and sketch the magnitude and phase as a function of frequency, including both positive and negative frequencies.

   (a) $x(t) = \delta(t - 5)$

   (b) $x(t) = e^{(-1+j2)t}u(t)$

2. **Fourier transform of arbitrary signals**

   Compute the Fourier transform of each of the following signals:

   (a) $x(t) = \{e^{-\alpha t}\cos(\omega_0 t)\}u(t), \quad \alpha > 0$

   (b) $x(t) = e^{-3|t|}\sin(2t)$

3. **Fourier transform properties**

   (a) **Linearity property.**
   In the lecture, we derived the transform of $x(t) = e^{-at}u(t)$. Using the linearity and scaling properties, derive the Fourier transform of $e^{-a|t|} = x(t) + x(-t)$.

   (b) **Duality property.**
   Using part (a) and the duality property, determine the fourier transform of

   $$x(t) = \frac{1}{1 + t^2}$$

   (c) **Scaling property.**

      i. If

      $$r(t) = \frac{1}{1 + (3t)^2}$$

      find $R(jw)$.

ii. $x(t)$ is sketched below. If $y(t) = x(\frac{t}{2})$, sketch $y(t)$, $Y(jw)$, and $X(jw)$.

$x(t)$

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