EE 1101: SIGNALS AND SYSTEMS JAN-MAY 2019

Tutorial 0: Complex numbers

Note: Electrical engineers use 'j' to denote $\sqrt{-1}$. This is because 'i' is used for the current.

1. Represent the following complex numbers in the polar form and plot them in the complex plane
   (a) $1 + j\sqrt{3}$
   (b) $-1 + j\sqrt{3}$
   (c) $-1 - j\sqrt{3}$
   (d) $1 - j\sqrt{3}$

2. Represent the following complex numbers in the Cartesian form and plot them in the complex plane
   (a) $2e^{j\frac{\pi}{6}}$
   (b) $-4e^{j\frac{\pi}{3}}$
   (c) $e^{j\frac{\pi}{2}}$
   (d) $3e^{-j\frac{\pi}{3}}$

3. Find (a) $z_1 + z_2$ (b) $z_1 z_2$ (c) $\frac{z_1}{z_2}$ (d) $z_1^{\frac{1}{2}}$ and (e) $|z_2|^2$ if
   (a) $z_1 = -2 + j$ and $z_2 = 3 + j4$
   (b) $z_1 = j + e^{\frac{\pi}{4}}$ and $z_2 = \cos j$

4. Evaluate distinct solutions of the equation $(w - (1 + j2))^5 = \frac{32}{\sqrt{2}}(1 + j)$. Locate the points in the complex plane.

5. (a) Find the real and imaginary part of the following function. Sketch both parts as a function of ω and mark critical points.
$$F(\omega) = \frac{1 + j2\omega}{3 + j4\omega}$$
   (b) Sketch the magnitude and phase of $F(\omega)$ as a function of ω.

6. Sketch the real and imaginary parts of the following complex exponentials as a function of time and mark critical points.
   (a) $f(t) = 2e^{j(2t-\frac{\pi}{3})}$, $0 \le t \le 3\pi$.
   (b) $f(t) = 2e^{-2t}e^{j(2t-\frac{\pi}{3})}$, $t \ge 0$.
   (c) $f(t) = 2e^{2t}e^{j(2t-\frac{\pi}{3})}$, $t \ge 0$.

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