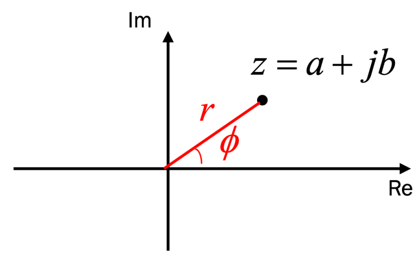
ECE 310 Recitation 1
Thursday Jan 21, 2021

Concept check

- √ Complex number
    - Cartesian form and polar form
        - Cartesian form: $z = a + jb, Re(z) = a, Im(z) = b$
        - Exponential/Polar form: $re^{j\phi}, r\angle\phi$
    - Magnitude and phase
        - Magnitude: $|z| = r = \sqrt{a^2 + b^2}$
        - Phase: $\arg(z) = \phi = \tan^{-1}\frac{b}{a}$
            - Range $(-\pi, \pi)$
    - Important formula
        - Euler formula: $z = re^{j\phi} = r(cos\phi + jsin\phi)$
        - De Moivre's formula: $e^{jn\phi} = (cos\phi + jsin\phi)^n = \cos(n\phi) + j\, sin(n\phi)$
    - Operations
        - Conjugation (in Cartesian form and polar form)
        - Addition / subtraction (in Cartesian form)
        - Multiplication / division (in Cartesian form and polar form)
- √ Linearity
    - $\mathcal{H}\{a_1x_1[n] + a_2x_2[n]\} = a_1\mathcal{H}\{x_1[n]\} + a_2\mathcal{H}\{x_2[n]\}$
- √ Time invariance / Shift invariance
    - $y[n] = \mathcal{H}\{x[n]\} \Rightarrow y[n - n_0] = \mathcal{H}\{x[n - n_0]\}$



Exercise

1. Simplify the following complex expressions:
    a. j^j
    b. $\frac{e^{-\frac{j\pi}{6}}}{1-j}$

2. Plot the magnitude and phase of the following functions:
    a. $Y(\omega) = 3jcos(\omega)$
    b. $Y(\omega) = \frac{e^{j\omega/2} - e^{-j3\omega/2}}{2j}$

3. Determine if the following systems are: 1) linear, 2) time-invariant. Justify your statements.
    a. $y[n]=\max(0, x[n])$
    b. $y[n] = x[|n| - n]$
    c. $y[n] = nx[n]$