

# ΗΥ215: Λύσεις 1ης Σειράς Ασκήσεων

2007

1.  $\frac{1}{2} + j\frac{\sqrt{3}}{2} = e^{j\pi/3}$

Οπότε  $(\frac{1}{2} + j\frac{\sqrt{3}}{2})^{100} = e^{j\pi 100/3} = e^{j(32 + \frac{4}{3})\pi} = e^{j\frac{4}{3}\pi}$

Άρα το αποτέλεσμα είναι μηδέν.

2.  $Re(1 + j)e^{j\theta} = \cos \theta - \sin \theta$

Άρα  $\cos \theta - \sin \theta = -1 \Rightarrow \theta = 2k\pi + \pi/2$  ή  $\theta = 2k\pi + \pi$

3.

$$\begin{aligned} \cos \theta_1 \cos \theta_2 + \sin \theta_1 \sin \theta_2 &= \frac{e^{j\theta_1} + e^{-j\theta_1}}{2} \frac{e^{j\theta_2} + e^{-j\theta_2}}{2} + \frac{e^{j\theta_1} - e^{-j\theta_1}}{2j} \frac{e^{j\theta_2} - e^{-j\theta_2}}{2j} \\ &= \frac{e^{j(\theta_1+\theta_2)} + e^{-j(\theta_1-\theta_2)} + e^{j(\theta_1-\theta_2)} + e^{-j(\theta_1+\theta_2)}}{4} - \frac{e^{j(\theta_1+\theta_2)} - e^{-j(\theta_1-\theta_2)} - e^{j(\theta_1-\theta_2)} + e^{-j(\theta_1+\theta_2)}}{4} \\ &= \frac{2[e^{j(\theta_1-\theta_2)} + e^{-j(\theta_1-\theta_2)}]}{4} = \cos(\theta_1 - \theta_2) \end{aligned}$$

4. Έστω  $z = \frac{3}{2}e^{j\pi/3} + 2e^{-j\pi/4} - e^{-j\pi/2}$

τότε το  $x(t)$  γράφεται ως:

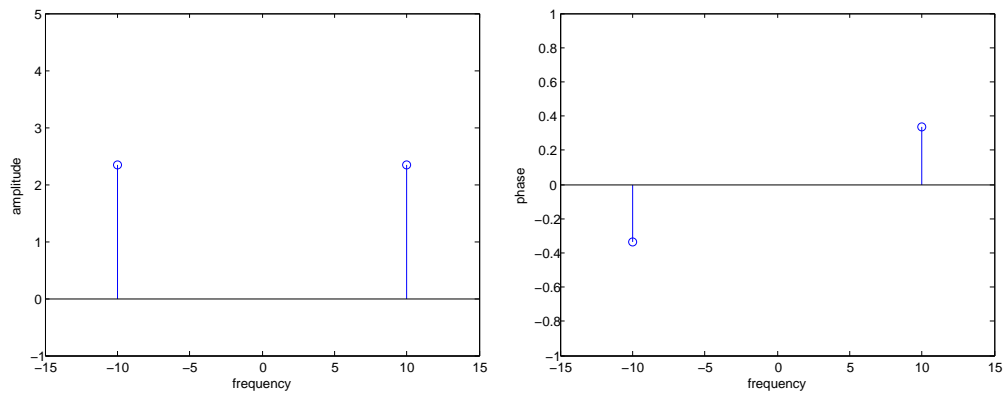
$$\begin{aligned} x(t) &= ze^{j2\pi 10t} + z^*e^{-j2\pi 10t} \\ &= |z|e^{j\phi}e^{j2\pi 10t} + |z|e^{-j\phi}e^{-j2\pi 10t} \\ &= 2|z|\cos(2\pi 10t + \phi) \end{aligned}$$

Άρα

$$A = 2|z|$$

$$\phi = \tan^{-1} \frac{Im(z)}{Re(z)}$$

Κάνοντας τις πράξεις:  $A \simeq 4.676$  και  $\phi \simeq 0.338$



5.  $dt = 1/200;$

$t = -1:dt:1;$

$x = 3*\cos(2*\pi*10*t+\pi/3) + 4*\cos(2*\pi*10*t-\pi/4) - 2*\sin(2*\pi*10*t);$

$xx = 4.676*\cos(2*\pi*10*t+0.338);$

$\text{plot}(t, x, 'b*-', t, xx, 'go-');$

$\text{title}('Sum of Sinusoids of 10 Hz');$

$\text{xlabel}('Time in sec');$