

$$\dot{C}_1(t) = C_2(t) \frac{i\Omega_R}{2} [e^{i\Omega t} + e^{-i\Omega t}]$$

$$\dot{C}_2(t) = C_1(t) \frac{i\Omega_R}{2} [e^{-i\Omega t} + e^{i\Omega t}]$$

(Γ) πριν από ομαδοποίηση προσέγγιση $\frac{\mu_B \Omega_R}{1}$

Α ΤΡΟΠΟΣ

Αν υποθέσουμε πως $e^{\dots} \sim 1$ δηλαδή $\Delta \sim 0, \Sigma \sim 0$

δηλαδή πως υπεργραφεί συντηρητική ο όρος $\frac{i\Omega_R}{2}$ εξω από την τετραγωνική παρενθεση.
external ext

Τότε οι εξισώσεις γίνονται:

$$\dot{C}_1(t) = C_2(t) \frac{i\Omega_R}{2} \cdot 2 = i\Omega_R C_2(t) \quad (\Omega_R)$$

$$\dot{C}_2(t) = C_1(t) \frac{i\Omega_R}{2} \cdot 2 = i\Omega_R C_1(t)$$

$$\ddot{C}_1(t) = i\Omega_R \dot{C}_2(t) = (i\Omega_R)^2 C_1(t)$$

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Δύο M $C_k(t) = U_k e^{i\lambda_k t} \Rightarrow \lambda_k^2 = \Omega_R^2$

$\lambda_k = \pm \Omega_R$

$$C_1(t) = A e^{i\Omega_R t} + B e^{-i\Omega_R t} \quad (M1)$$

$$C_2(t) = \Gamma e^{i\Omega_R t} + \Delta e^{-i\Omega_R t} \quad (M2)$$

A.S. $C_1(0) = 1, C_2(0) = 0$

$$1 = A + B \quad (1)$$

$$0 = \Gamma + \Delta \Rightarrow \Delta = -\Gamma \quad (2)$$

(Ω_R) (M1) (M2) ⇒

$$A i\Omega_R (e^{i\Omega_R t} + B (-i\Omega_R) e^{-i\Omega_R t}) = i\Omega_R (\Gamma e^{i\Omega_R t} + \Delta e^{-i\Omega_R t}) \quad t=0$$

$$A - B = \Gamma + \Delta \quad (3)$$

$$\Gamma i\Omega_R e^{i\Omega_R t} + \Delta (-i\Omega_R) e^{-i\Omega_R t} = i\Omega_R (A e^{i\Omega_R t} + B e^{-i\Omega_R t}) \quad t=0$$

$$\Gamma - \Delta = A + B \quad (4)$$

(1)(2)(3)(4) $\Delta = -\Gamma \quad A = B \quad 2\Gamma = 2A \quad \Gamma = A \quad 1 = A + A = 2A$

$$A = B = \Gamma = \frac{1}{2} = -\Delta \quad (5)$$

$$C_1(t) = \frac{e^{i\Omega_R t} + e^{-i\Omega_R t}}{2} \Rightarrow C_1(t) = \cos(\Omega_R t) \Rightarrow P_1(t) = \cos^2(\Omega_R t) = \frac{1}{2} + \frac{1}{2} \cos(2\Omega_R t)$$

$$C_2(t) = \frac{e^{i\Omega_R t} - e^{-i\Omega_R t}}{2} \Rightarrow C_2(t) = i \sin(\Omega_R t) \Rightarrow P_2(t) = \sin^2(\Omega_R t) = \frac{1}{2} - \frac{1}{2} \cos(2\Omega_R t)$$

$$\frac{1}{f} = T = \frac{2\pi}{2\Omega_R} = \frac{\pi}{\Omega_R} \quad A = 1$$

$$\begin{aligned} \dot{C}_1(t) &= i\Omega_R C_2(t) \\ \dot{C}_2(t) &= i\Omega_R C_1(t) \end{aligned}$$

$$\begin{bmatrix} \dot{C}_1(t) \\ \dot{C}_2(t) \end{bmatrix} = \begin{bmatrix} 0 & i\Omega_R \\ i\Omega_R & 0 \end{bmatrix} \begin{bmatrix} C_1(t) \\ C_2(t) \end{bmatrix}$$

$$\dot{\vec{x}}(t) = iA \vec{x}(t)$$

$$\frac{\mu_B \Omega_R}{2}$$

$$\text{Soln } \vec{x}(t) = \vec{u} e^{i\lambda t}$$

$$\dot{\vec{x}}(t) = i\lambda \vec{u} e^{i\lambda t}$$

$$\dot{\vec{x}}(t) = iA \vec{x}(t) \Rightarrow \vec{u} i\lambda e^{i\lambda t} = iA \vec{u} e^{i\lambda t} \Rightarrow A \vec{u} = \lambda \vec{u}$$

$$(A - \lambda I) \vec{u} = \vec{0}$$

$$\det(A - \lambda I) = 0 \Rightarrow \begin{vmatrix} -\lambda & \Omega_R \\ \Omega_R & -\lambda \end{vmatrix} = 0 \Rightarrow \lambda^2 = \Omega_R^2 \Rightarrow \lambda = \pm \Omega_R$$

$$\textcircled{\alpha} \lambda_1 = -\Omega_R \quad \begin{bmatrix} 0 & \Omega_R \\ \Omega_R & 0 \end{bmatrix} \begin{bmatrix} u_{11} \\ u_{21} \end{bmatrix} = -\Omega_R \begin{bmatrix} u_{11} \\ u_{21} \end{bmatrix} \Rightarrow \begin{cases} \Omega_R u_{21} = -\Omega_R u_{11} \\ \Omega_R u_{11} = -\Omega_R u_{21} \end{cases} \Rightarrow$$

$$\vec{u}_1 = \begin{bmatrix} c \\ -c \end{bmatrix} \quad |\vec{u}_1|^2 = 1 \Rightarrow 2|c|^2 = 1 \Rightarrow |c|^2 = 1/2 \quad (u_{21} = -u_{11})$$

$$\text{n.x. } c = \frac{1}{\sqrt{2}}$$

$$\vec{u}_1 = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$$\textcircled{\beta} \lambda_2 = \Omega_R \quad \begin{bmatrix} 0 & \Omega_R \\ \Omega_R & 0 \end{bmatrix} \begin{bmatrix} u_{12} \\ u_{22} \end{bmatrix} = \Omega_R \begin{bmatrix} u_{12} \\ u_{22} \end{bmatrix} \Rightarrow \begin{cases} \Omega_R u_{22} = \Omega_R u_{12} \\ \Omega_R u_{12} = \Omega_R u_{22} \end{cases} \Rightarrow u_{12} = u_{22}$$

$$\vec{u}_2 = \begin{bmatrix} c \\ c \end{bmatrix} \quad |\vec{u}_2|^2 = 1 \Rightarrow 2|c|^2 = 1 \Rightarrow |c|^2 = 1/2 \Rightarrow \text{n.x. } c = \frac{1}{\sqrt{2}}$$

$$\vec{u}_2 = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$\text{Γενική λύση} \quad \vec{x}(t) = \sigma_1 \vec{u}_1 e^{i\lambda_1 t} + \sigma_2 \vec{u}_2 e^{i\lambda_2 t}$$

$$\begin{bmatrix} C_1(t) \\ C_2(t) \end{bmatrix} = \sigma_1 \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ -1 \end{bmatrix} e^{-i\Omega_R t} + \sigma_2 \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ 1 \end{bmatrix} e^{i\Omega_R t}$$

A.Σ. $C_1(0) = 1$ $C_2(0) = 0$

$$1 = \frac{\sigma_1}{\sqrt{2}} + \frac{\sigma_2}{\sqrt{2}}$$

$$0 = -\frac{\sigma_1}{\sqrt{2}} + \frac{\sigma_2}{\sqrt{2}} \Rightarrow \sigma_1 = \sigma_2 := \sigma$$

$$1 = 2 \frac{\sigma}{\sqrt{2}} \Rightarrow \sigma = \frac{\sqrt{2}}{2} \quad \frac{\text{μεγαλο}}{3}$$

$$C_1(t) = \frac{1}{2} e^{-i\Omega t} + \frac{1}{2} e^{i\Omega t} \Rightarrow C_1(t) = \frac{e^{-i\Omega t} + e^{i\Omega t}}{2} \Rightarrow$$

$$C_2(t) = -\frac{1}{2} e^{-i\Omega t} + \frac{1}{2} e^{i\Omega t} \Rightarrow C_2(t) = \frac{e^{i\Omega t} - e^{-i\Omega t}}{2} \Rightarrow$$

$$C_1(t) = \cos(\Omega t) \Rightarrow P_1(t) = \cos^2(\Omega t) = \frac{1}{2} + \frac{1}{2} \cos(2\Omega t)$$

$$C_2(t) = i \sin(\Omega t) \Rightarrow P_2(t) = \sin^2(\Omega t) = \frac{1}{2} - \frac{1}{2} \cos(2\Omega t)$$

$$\frac{1}{f} = T = \frac{2\pi}{\Omega} = \frac{\pi}{\Omega} \quad A = 1$$

- Τίτλος ερωτήσεων
- Τύπος ερωτήσεων: ερωτήσεις πολλαπλής επιλογής, ερωτήσεις ανοικτού τύπου
- Τύπος κλειστού: ερωτήσεις α/β, γ/δ
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