

応用数理解析

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演習問題 4

$$\ddot{x}(t) + \omega^2 x(t) = 0, x(t) = A \cos(\omega t + \psi), \dot{x}(t) = -A\omega \sin(\omega t + \psi)$$

$$x(0) = A \cos \psi = a \quad \dots \textcircled{1}$$

$$\dot{x}(0) = -A\omega \sin \psi = 0 \quad \dots \textcircled{2} \quad (\text{初期条件より})$$

$$\text{これを解くと } \textcircled{2} \text{ より } \psi = n\pi \quad (n \in \mathbb{Z})$$

$$\textcircled{1} \text{ に代 } x \quad A \cos n\pi = a$$

$$A = \frac{a}{\cos n\pi}$$

よ、初期条件を満たす解は

$$\begin{aligned} x(t) &= \frac{a}{\cos n\pi} \cos(\omega t + n\pi) = \frac{a}{\cos n\pi} (\cos \omega t \cos n\pi - \sin \omega t \sin n\pi) \\ &= \frac{a}{\cos n\pi} \cos \omega t \cos n\pi = \underline{a \cos \omega t} \quad \text{H} \end{aligned}$$

演習問題 5

$$\ddot{x}(t) + \omega^2 x(t) = 0, x(t) = A \sin(\omega t + \phi)$$

$$x(0) = A \sin \phi = 0 \quad \dots \textcircled{1}$$

$$\dot{x}(0) = A\omega \cos \phi = a \quad \dots \textcircled{2} \quad (\text{初期条件より})$$

$$\text{これを解くと } \textcircled{1} \text{ より } \phi = n\pi \quad (n \in \mathbb{Z})$$

$$\textcircled{2} \text{ に代 } x \quad A\omega \cos n\pi = a$$

$$A = \frac{a}{\omega \cos n\pi}$$

よ、初期条件を満たす解は

$$\begin{aligned} x(t) &= \frac{a}{\omega \cos n\pi} \cdot \sin(\omega t + n\pi) \\ &= \frac{a}{\omega \cos n\pi} (\sin \omega t \cos n\pi + \cos \omega t \sin n\pi) \\ &= \underline{\frac{a}{\omega} \sin \omega t} \quad \text{H} \end{aligned}$$