Engineering Mathematics(III)

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HW No.1

Solve the particular solution (steady state solution) of the SDOF vibration system $\ddot{x} + 2\xi\omega\dot{x} + \omega^2 x = cos(\bar{\omega}t)$ by

(1). conventional method.

(2). method of complex variables.

(3). Discuss the change of amplitude and phase between input and output.

(4). Repeat (1), (2) and (3) steps if $\bar{\omega} = \omega$ and $\xi = 0$?

(5). Repeat (1), (2) and (3) steps if $\bar{\omega} = \omega$ and $\xi \neq 0$?

(6). Can the solution be derived by limiting process

$\bar{\omega} \to \omega$, if $\xi \neq 0$

$\bar{\omega} \to \omega$, if $\xi = 0$?

(Hint: by superimposing the complementary solution before taking limit)

HW No.2

Solve $z^4 = 1$ and plot in the complex plane.

HW No.3

The first root of Hw No.2 is defined $W = e^{-2\pi i/4}$. In discrete Fourier transform, we have

$$X(n) = \sum_{k=0}^{N-1} x_0(k)\, e^{-i2\pi nk/N}, \quad n = 0, 1, \cdots, N-1$$

For $N = 4$, prove that

$$\begin{bmatrix} X(0) \\ X(2) \\ X(1) \\ X(3) \end{bmatrix} = \begin{bmatrix} 1 & W^0 & 0 & 0 \\ 1 & W^2 & 0 & 0 \\ 0 & 0 & 1 & W^1 \\ 0 & 0 & 1 & W^3 \end{bmatrix} \begin{bmatrix} 1 & 0 & W^0 & 0 \\ 0 & 1 & 0 & W^0 \\ 1 & 0 & W^2 & 0 \\ 0 & 1 & 0 & W^2 \end{bmatrix} \begin{bmatrix} x_0(0) \\ x_0(1) \\ x_0(2) \\ x_0(3) \end{bmatrix}$$

Note: This step is the factorization in FFT(Fast Fourier Transform).

【存檔：E:/ctex/course/math3/94hw1.te】【建檔:Nov./3/'94】