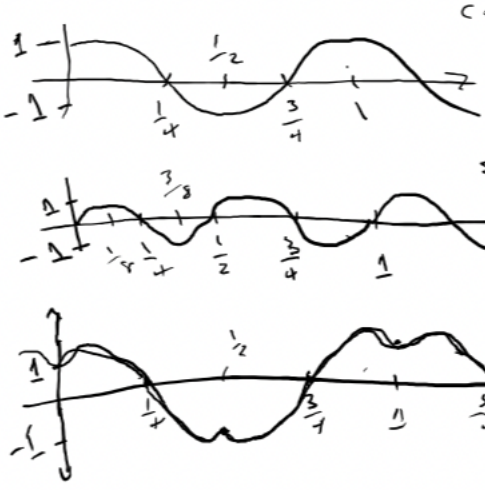
Lecture on 2021 Sep 8

Tuesday, September 7, 2021 11:00



$$= \sum_{k=-2}^{2} X_k e^{j 2\pi k F_0 t} \qquad F_0 = 1\ \text{Hz}$$

$$X_k = \begin{cases} \frac{1}{2} & k = \pm 1 \\ \frac{1}{2j} & k = 2 \\ -\frac{1}{2j} & k = -2 \\ 0 & k = 0 \text{ OR } |k| > 2 \end{cases}$$

$$y(t) = \frac{dx}{dt} \longleftrightarrow Y_k = j 2\pi k F_0 X_k$$

$$Y_k = \begin{cases} \frac{1}{2} \cdot j 2\pi = j\pi & k = 1 \\ \frac{1}{2} \cdot j 2\pi (-1) = -j\pi & k = -1 \\ \frac{1}{2j} \cdot j 2\pi 2 = 2\pi & k = 2 \\ -\frac{1}{2j} \cdot j 2\pi \cdot (-2) = 2\pi & k = -2 \end{cases}$$

$$y(t) = j\pi e^{j\pi t 2} - j\pi e^{-j\pi t 2} + 2\pi e^{j 4\pi t} + 2\pi e^{-j 4\pi t} = \sum_k Y_k e^{j 2\pi k F_0 t}$$

$$= j\pi \left(e^{j 2\pi t} - e^{-j 2\pi t} \right) + 2\pi \left(e^{j 4\pi t} + e^{-j 4\pi t} \right)$$

$$= j\pi \left(2j \sin(2\pi t) \right) + 2\pi \left(2 \cos(4\pi t) \right)$$

$$= -2\pi \sin(2\pi t) + 4\pi \cos(4\pi t)$$