Project – DCT Design

● 設計描述

設計一個 1-D 8-point Discrete Cosine Transform (DCT)，1-D DCT 猶如一個矩陣運算，下面即是設計描述：

$$Z(n) = \sqrt{\frac{2}{N}} c(n) \sum_{m=0}^{N-1} x(m) \times \cos\left(\frac{(2m+1)n\pi}{2N}\right)$$

where

$$C(n) = \begin{cases} 1/\sqrt{2} & \text{for} \quad n = 0 \\ 1 & \text{for} \quad others \end{cases}$$

利用矩陣展開

$$Z = \begin{bmatrix} Z_0 \\ Z_1 \\ Z_2 \\ Z_3 \\ Z_4 \\ Z_5 \\ Z_6 \\ Z_7 \end{bmatrix} = \begin{bmatrix} \cos 4\theta & \cos 4\theta & \cos 4\theta & \cos 4\theta & \cos 4\theta & \cos 4\theta & \cos 4\theta & \cos 4\theta \\ \cos\theta & \cos 3\theta & \cos 5\theta & \cos 7\theta & -\cos 7\theta & -\cos 5\theta & -\cos 3\theta & -\cos\theta \\ \cos 2\theta & \cos 6\theta & -\cos 6\theta & -\cos 2\theta & -\cos 2\theta & -\cos 6\theta & \cos 6\theta & \cos 2\theta \\ \cos 3\theta & -\cos 7\theta & -\cos\theta & -\cos 5\theta & \cos 5\theta & \cos\theta & \cos 7\theta & -\cos 3\theta \\ \cos 4\theta & -\cos 4\theta & -\cos 4\theta & \cos 4\theta & \cos 4\theta & -\cos 4\theta & -\cos 4\theta & \cos 4\theta \\ \cos 5\theta & -\cos\theta & \cos 7\theta & \cos 3\theta & -\cos 3\theta & -\cos 7\theta & \cos\theta & -\cos 5\theta \\ \cos 6\theta & -\cos 2\theta & \cos 2\theta & -\cos 6\theta & -\cos 6\theta & \cos 2\theta & -\cos 2\theta & \cos 6\theta \\ \cos 7\theta & -\cos 5\theta & \cos 3\theta & -\cos\theta & \cos\theta & -\cos 3\theta & \cos 5\theta & -\cos 7\theta \end{bmatrix} \cdot \begin{bmatrix} x_0 \\ x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \end{bmatrix}$$

$$where \quad \theta = \pi/16$$

1. Please finish this DCT before 2021/1/13, and give a presentation on the class of 2021/1/13.
2. A technique report about this filter is also needed. Please upload the report to E-learning system before 2021/1/15.