

Discrete Fourier Transform for Dummies

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1. Introduction

2. 1D DFT Definition

$$F(u) = \sum_{x=0}^{M-1} f(x) e^{-j2\pi ux/N} \quad (1)$$

where $u = 0, 1, 2, \dots, M-1$

$$f(x) = \frac{1}{M} \sum_{u=0}^{M-1} F(u) e^{j2\pi ux/N} \quad (2)$$

where $x = 0, 1, 2, \dots, M-1$

3. 2D DFT Definition

$$F(k, l) = \frac{1}{MN} \sum_{m=0}^{M-1} \sum_{n=0}^{N-1} f(m, n) e^{-j2\pi(\frac{km}{M} + \frac{ln}{N})} \quad (3)$$

where $m = 0, 1, 2, \dots, M-1$ and $n = 0, 1, 2, \dots, N-1$

$$f(m, n) = \sum_{k=0}^{M-1} \sum_{l=0}^{N-1} F(k, l) e^{j2\pi(\frac{km}{M} + \frac{ln}{N})} \quad (4)$$

where $k = 0, 1, 2, \dots, M-1$ and $l = 0, 1, 2, \dots, N-1$