

Fourier Series Report

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1 Signals Definition

We define the following signals as such

1.1 Box Signal

1.1.1 Definition

$$f(x) = \begin{cases} b & -a \leq x \leq a \\ 0 & otherwise \end{cases}$$

$$a : [\frac{\pi}{4}, \frac{\pi}{2}]$$

$$b : [-1, 0)U(0, 1]$$

1.1.2 Fourier Coefficients(analytical solution)

$$f(x) = \begin{cases} 2ab & k = 0 \\ \frac{2b*\sin(ak)}{k} & k \neq 0 \end{cases}$$

1.2 Saw Signal

$$f(x) = \begin{cases} bx & -a \leq x \leq a \\ 0 & otherwise \end{cases}$$

$$a : [\frac{\pi}{4}, \frac{\pi}{2}]$$

$$b : [-1, 0)U(0, 1]$$

1.1.2 Fourier Coefficients(analytical solution)

$$f(x) = \begin{cases} 0 & k = 0 \\ \frac{2ib*(\sin(ak)-ak*\cos(ak))}{k^2} & k \neq 0 \end{cases}$$

1.3 Exponential Signal

$$f(x) = \begin{cases} c + e^{-bx} & -a \leq x \leq a \\ 0 & otherwise \end{cases}$$

$$a : [\frac{\pi}{4}, \frac{\pi}{2}]$$

$$b : [-1, 0)U(0, 1]$$

$$c : [-3, -1)U(-1, 1]$$

1.4 Sinusoidal Signal

$$f(x) = \left\{ \begin{array}{ll} c * \sin(bx) & -a \leq x \leq a \\ 0 & otherwise \end{array} \right\}$$

$$a : [\frac{\pi}{4}, \frac{\pi}{2}]$$

$$b : [-1, 0) \cup (0, 1]$$

$$c : [-3, -1) \cup (-1, 1]$$

1.5 Gaussian Signal

$$f(x) = \left\{ \begin{array}{ll} e^{-ax^{2b}} & -a \leq x \leq a \\ 0 & otherwise \end{array} \right\}$$

$$a : [\frac{\pi}{4}, \frac{\pi}{2}]$$

$$b : [-10, -1) \cup (1, 10]$$

II. Fourier Coefficients

we define the fourier coeffici

III. Fourier Classifications