

Chem237: Lecture 5

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Approximate Bounds

Fourier Transform

A Fourier transform is a generalization of the complex Fourier series as the limit $L \rightarrow \infty$ defined as :

$$g(y) = \int_{-\infty}^{\infty} f(x) e^{ixy} dx \quad (1)$$

And its inverse Fourier transform is defined by :

$$f(x) = \int_{-\infty}^{\infty} g(y) e^{-ixy} dy \quad (2)$$

Before this is discussed more thoroughly we will talk about Fourier Series.

Fourier Series

A Fourier series is a method to write a periodic function in terms of Sines Cosines. A fourier series is written in the form of :

$$f(\theta) = \frac{A_0}{2} + \sum_{n=1}^{\infty} (A_n \cos(n\theta) + B_n \sin(n\theta)) \quad (3)$$

The coefficients A_n and B_n can be found by multiplying the function by multiply each by $\cos(n\theta)$ and $\sin(n\theta)$:

$$A_n = \frac{1}{\pi} \int_0^{2\pi} f(\theta) \cos(n\theta) d\theta \quad (4)$$

$$B_n = \frac{1}{\pi} \int_0^{2\pi} f(\theta) \sin(n\theta) d\theta \quad (5)$$

The A_0 term can be found by plugging in $n=0$ and getting :

$$A_0 = \frac{2}{L} \int_0^L f(x) dx \quad (6)$$

Where L is the period.