

## Exponential version of Fourier Series

Fourier series may also be written in a more compact notation:

$$\Psi(x) = \sum_{n=1}^{\infty} (C_n^* e^{ik_n x})$$
$$C_n^* = \text{Re}[C_n] + i[\text{Im}[C_n]]; \quad C_n^* = \frac{A_n}{2} - i\frac{B_n}{2}; \quad A_n = 2\text{Re}[C_n]; \quad B_n = -2\text{Im}[C_n]$$

This is the equivalent to the cosine-first version:

$$\Psi(x) = \sum_{n=1}^{\infty} (A_n \cos k_n x + B_n \sin k_n x)$$

$$A_n = \frac{2}{L} \int_0^L \Psi(x) \cos \frac{2\pi n x}{L} dx$$

$$B_n = \frac{2}{L} \int_0^L \Psi(x) \sin \frac{2\pi n x}{L} dx$$

$$\Psi(x) = C_n \cos(k_n x + \phi_n)$$