

1. Complex Discrete Fourier Transform

$$Z(n) = \frac{1}{T} \int_{-T/2}^{T/2} x(t) e^{-jn\omega_0 t} dt \text{ for } -\infty < n < \infty$$

2. Complex Inverse Discrete Fourier Transform (Complex Fourier Series Representation)

$$x(t) = \sum_{n=-\infty}^{\infty} Z(n) e^{jn\omega_0 t}$$

3. Real-Valued Discrete Fourier Transform (Cartesian Form)

$$A(n) = \frac{2}{T} \int_{-T/2}^{T/2} x(t) \cos(n\omega_0 t) dt \text{ (Real)}$$

$$B(n) = \frac{2}{T} \int_{-T/2}^{T/2} x(t) \sin(n\omega_0 t) dt \text{ (Imaginary)}$$

4. Real-Valued Inverse Discrete Fourier Transform (Real-Valued Fourier Series Representation)

$$x(t) = \frac{A(0)}{2} + \sum_1^{\infty} [A(n) \cos(n\omega_0 t) + B(n) \sin(n\omega_0 t)]$$

5. Transformation from Cartesian to Polar Form

$$|Z(n)|^2 = A(n)^2 + B(n)^2 \quad \text{(Power)}$$

$$\theta(n) = \arctan\left(\frac{B(n)}{A(n)}\right) \quad \text{(Phase)}$$