

Digital Signal Processing

Periodic Sampling

$$x(n) = \sin(2\pi n f / f_s) = \sin(2\pi n(f + k f_s) / f_s) \quad k \in \mathbb{Z}$$

Continuous Fourier Transform

$$X(f) = \int_{-\infty}^{+\infty} x(t) e^{-i2\pi ft} dt$$

Discrete Fourier Transform

$$X(m) = \sum_{n=1}^{N-1} x(n) e^{-i2\pi nm/N} \quad 0 \leq m \leq N$$

$$\text{frequency}(m) = \frac{mf_s}{N}$$

$$\text{amplitude}(m) = \frac{2}{N} |X(m)|$$

$$\text{phase angle}(m) = \text{argument}(X(m))$$

For real inputs, $X(m)$ is the complex conjugate of $X(N - m)$.