

2-D Sine Waves

- A 2-D sine wave is the inverse transform of an impulse in the 2-D frequency domain.

$$F(u, v) = \delta(u - u_o, v - v_o)$$

$$\begin{aligned} f(x, y) &= \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \delta(u - u_o, v - v_o) e^{j2\pi(ux+vy)} du dv \\ &= e^{j2\pi(u_o x + v_o y)} \end{aligned}$$

- We know that

$$\cos(2\pi(u_o x + v_o y)) = \frac{1}{2} \left[e^{j2\pi(u_o x + v_o y)} + e^{-j2\pi(u_o x + v_o y)} \right]$$

- So we have that

$$\cos(2\pi(u_o x + v_o y)) \stackrel{CSFT}{\Leftrightarrow} \frac{1}{2} [\delta(u - u_o, v - v_o) + \delta(u + u_o, v + v_o)]$$