Q.1 Synthesis = $F(u,v) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(x,y)\, e^{-j2\pi(ux+vy)}\, dx\,dy$

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freq. dom.

Analysis = $f(x,y) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} F(u,v)\, e^{j2\pi(ux+vy)}\, du\,dv$ → $\cos(2\pi(ux+vy)) + j\sin(2\pi(ux+vy))$

Maxima & minima at $n\pi$.

$F(u,v)$ is complex exp, $\Rightarrow F_r(u,v) + jF_I(u,v)$

For Delta func. unit ~~step~~, impulse:

$f(x,y) = \delta(x,y)$

$F(u,v) = \iint \delta(x,y)\, e^{-j2\pi(xu+vy)}\, dx\,dy$

$= 1$

- $f(x,y)$ is decomposed into weighed sum of 2D orthogonal weight basis functions showing change in x & y.

Let $x(u,v)$ be periodic,

in 1D we had $\tilde{x}(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk\omega_0 t}$ $a_k = \frac{1}{T_0}\int_{-T/2}^{T/2} \tilde{x}(t)\, e^{-jk\omega_0 t}\, dt$

In 2d, we will analyze each axis seperately using integral form. given

$x(j\omega) = \int_{-\infty}^{\infty} x(t)\, e^{-j\omega t}\, dt$

$x(j\omega_1, v) = \int_{-\infty}^{\infty} x(u,v)\, e^{-j\omega_1 u}\, du$

$x(u, j\omega_2) = \int_{-\infty}^{\infty} x(u,v)\, e^{-j\omega_2 v}\, dv$

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