(4)

$$g(s,\theta) = \iint \delta(s - x\cos\theta - y\sin\theta) f(x,y)\,dx\,dy$$

$$\int g(s,\theta) z(s)\,ds$$

$$= \int_s \left(\iint_{x\,y} \delta(s - x\cos\theta - y\sin\theta) f(x,y)\,dx\,dy \right) z(s)\,ds$$

$$= \iint_{x\,y} f(x,y) \int_s \delta(s - x\cos\theta - y\sin\theta) z(s)\,ds\,dx\,dy$$

$$= \iint_{x\,y} f(x,y)\, z(x\cos\theta + y\sin\theta)\,dx\,dy \quad \text{— (A)}$$

Fourier Slice Theorem

$$G(s,\theta) = \iint f(x,y)\, e^{-j2\pi s(x\cos\theta + y\sin\theta)}\,dx\,dy$$

$$G(s,\theta) = \left[F(u,v) \right]_{u = s\cos\theta,\ v = s\sin\theta}$$

in (A) $z(t) = e^{-j2\pi s t}$

Now putting $t = x\cos\theta + y\sin\theta \Rightarrow z(t) = e^{-j2\pi s(x\cos\theta + y\sin\theta)}$

it becomes Fourier Slice Theorem.