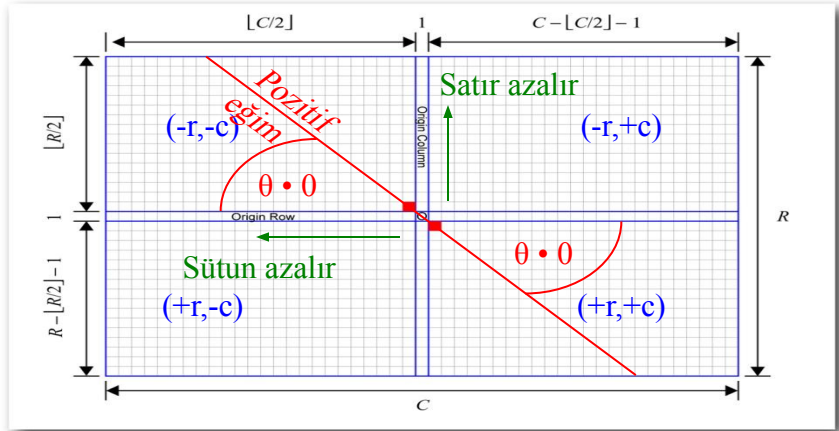
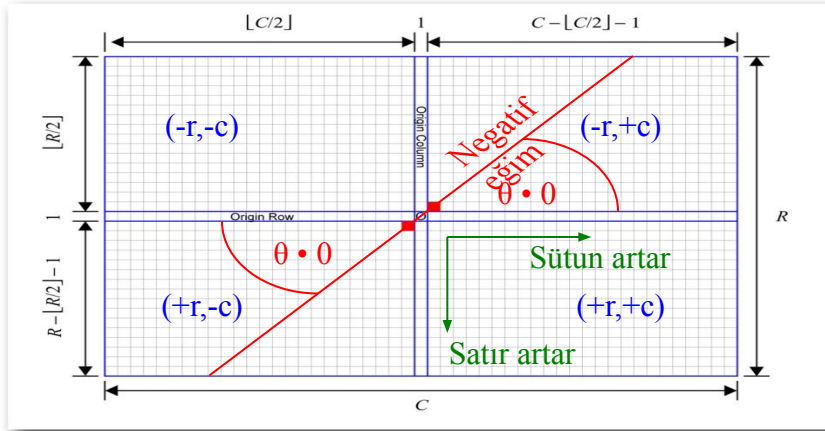


Fourier-2D Örnekler

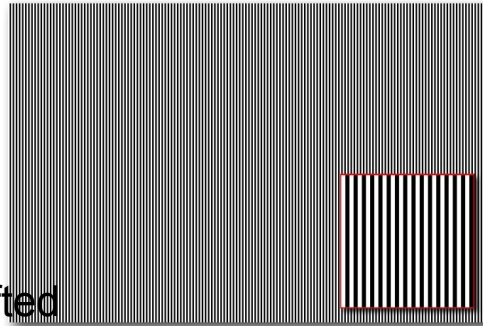
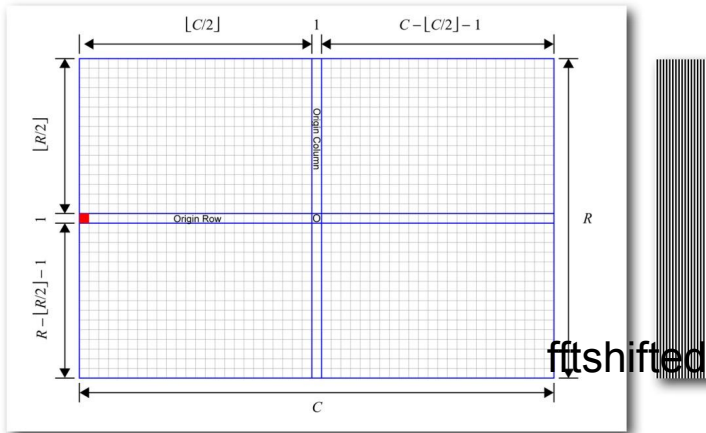
Fourier Düzleminde Koordinat ve Yönler



Aşağı gidildikçe satırlar sağa gidildikçe sütunlar artmaktadır. Eğim ve açılar bunlara zıttır.

Impulse'ın ters FFT'si

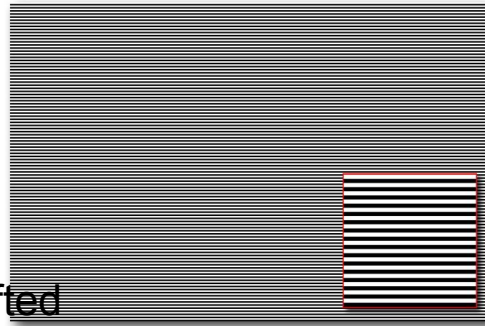
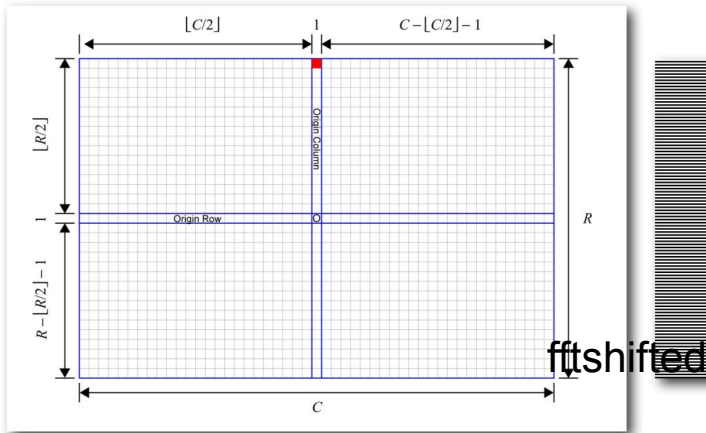
Dalga yönü "yatay" dır.



En yüksek frekans yatay sinüzoiddir

Impulse'ın ters FFT'si

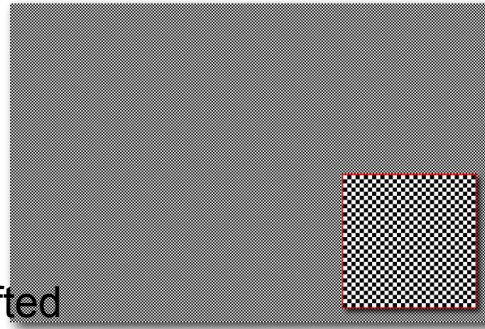
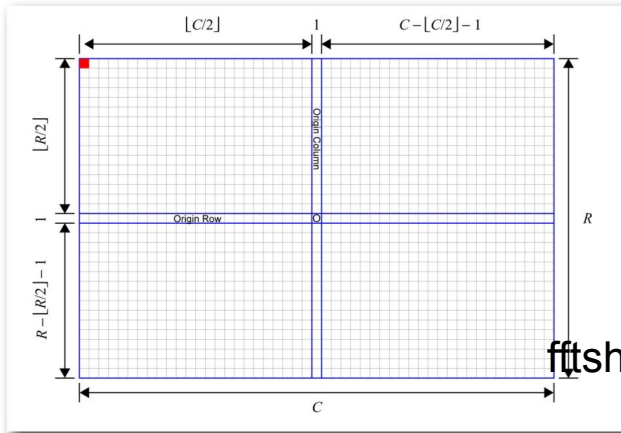
Dalga yönü "dikeydir" dır.



En yüksek frekans dikey sinüzoiddir

Impulse'ın ters FFT'si

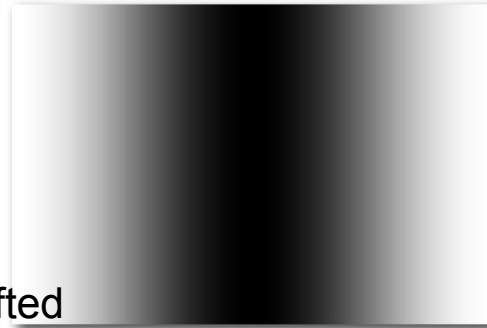
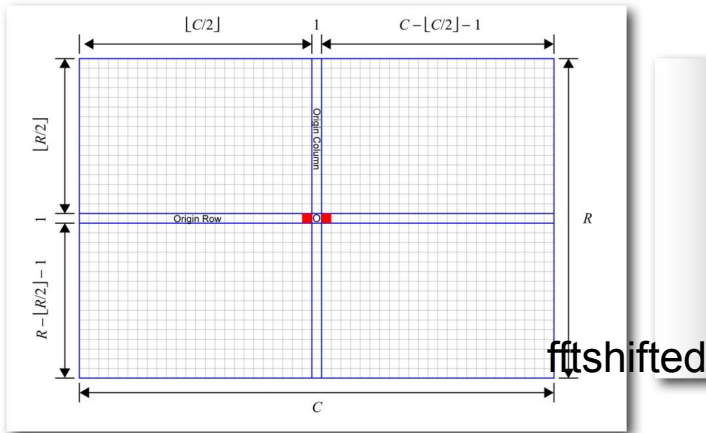
Satranç tahtası örüntüsü



En yüksek frekans yatay + dikey sinüzoiddir

Impulse'ın ters FFT'si

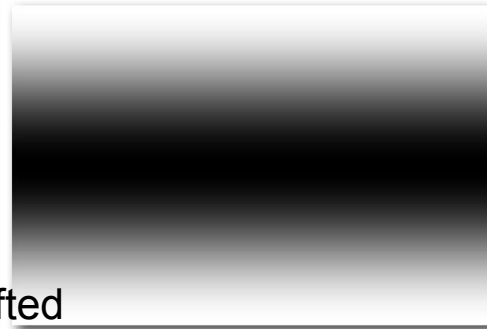
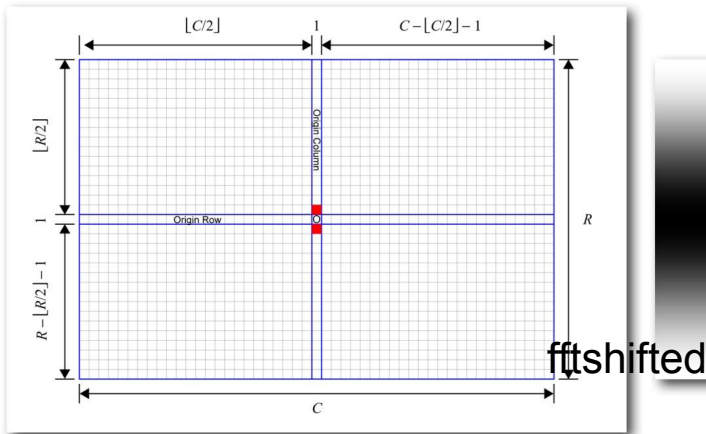
Dalga yönü "yatay" dır.



En düşük frekans yatay sinüzoiddir

Impulse'ın ters FFT'si

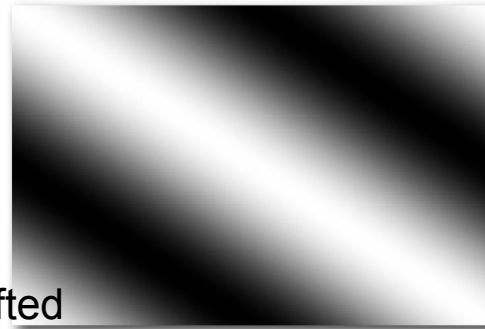
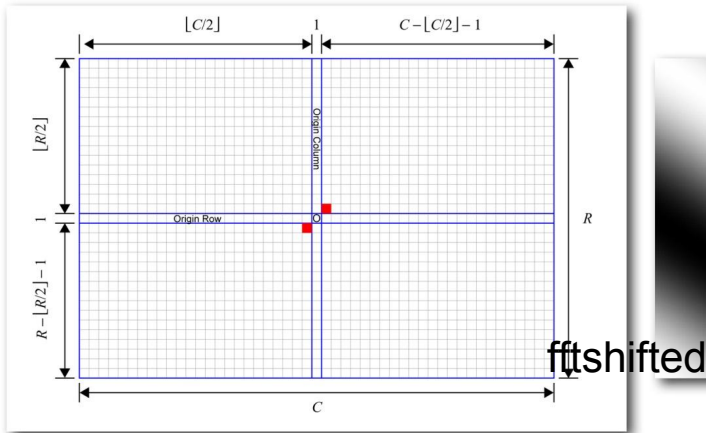
Dalga yönü dikeydir



En düşük frekans dikey sinüzoiddir

Impulse'ın ters FFT'si

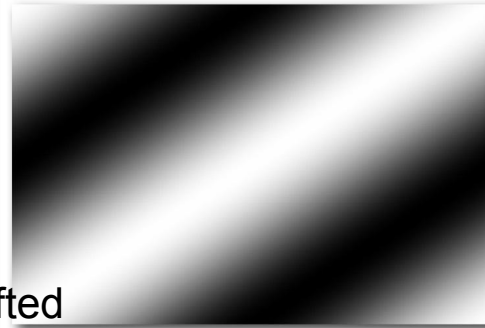
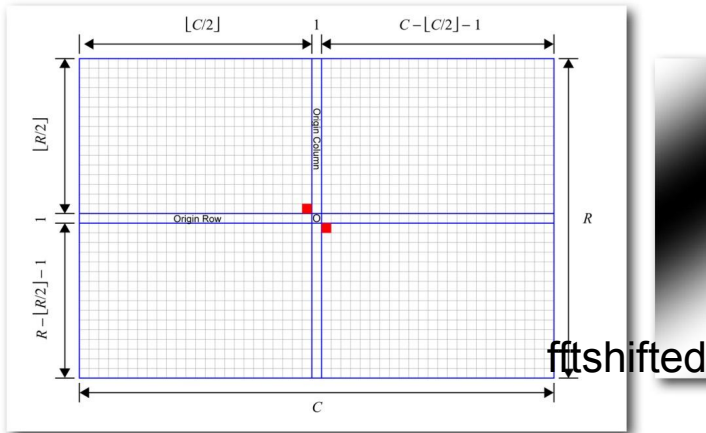
Dalga yönü negatif diyagonal



En düşük frekans negatif diyagonal sinüzoiddir

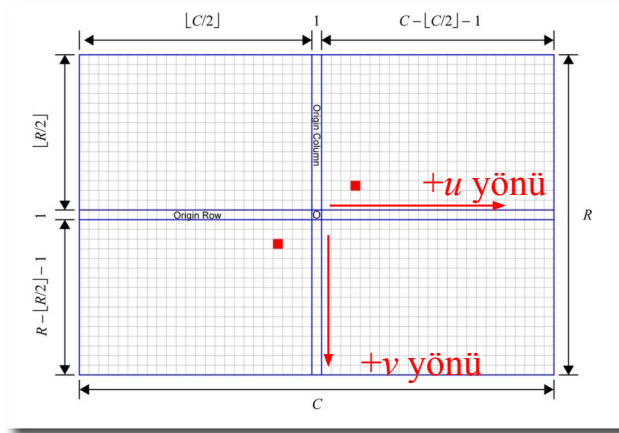
Impulse'ın ters FFT'si

Dalga yönü pozitif diyagonal

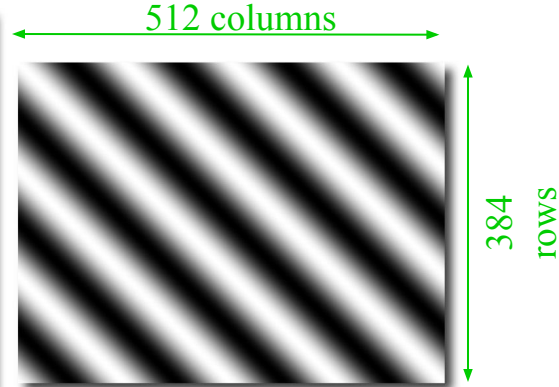


En düşük frekans pozitif diyagonal sinüzoiddir

Fourier düzlemindeki frekanslar ve dalga boyları



Dikkat etki...

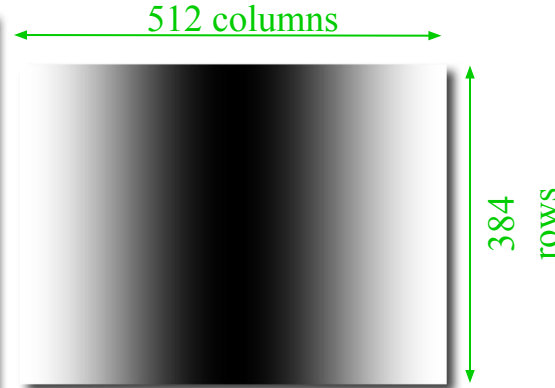
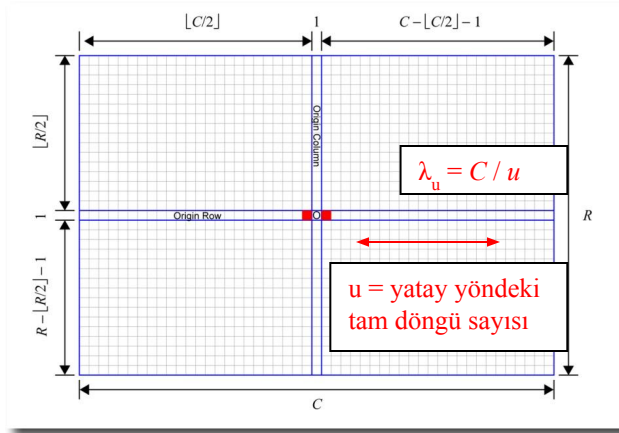


... ve bu.

frekanslar: $(u, v) = (4, 3)$; dalga boyları: $(\lambda_u, \lambda_v) = (128, 128)$

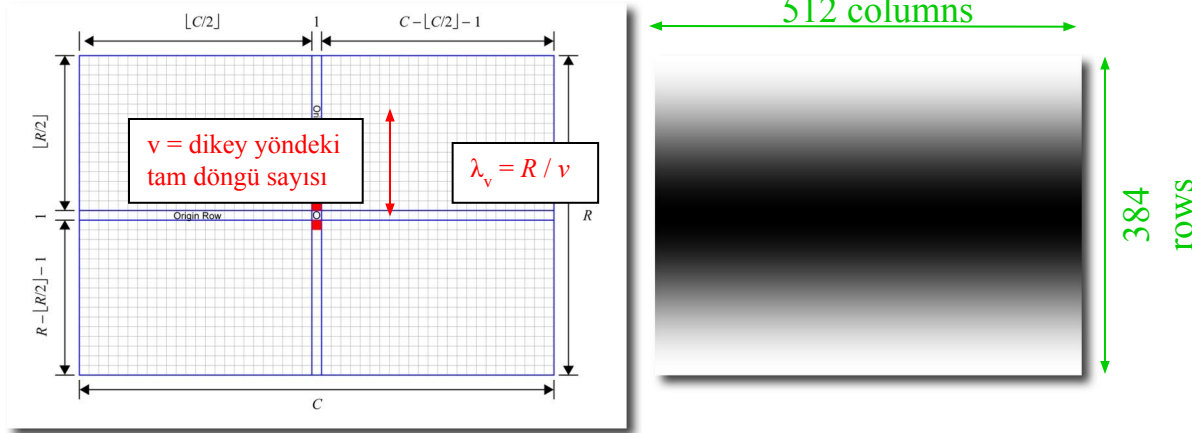
Nasıl olabilir?

Fourier düzlemindeki frekanslar ve dalga boyları



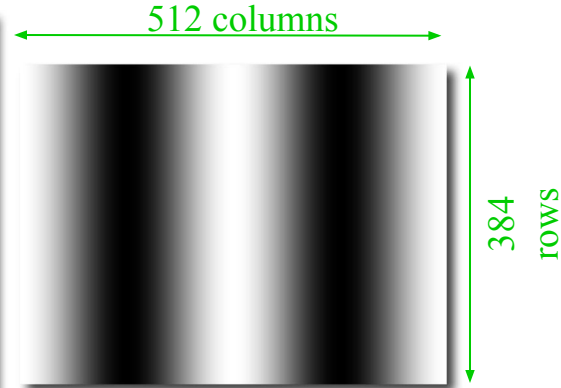
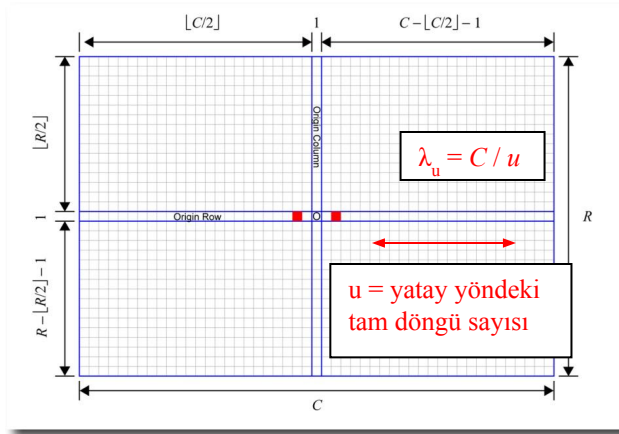
frekanslar: $(u, v) = (1, 0)$; dalga boyu: $\lambda_u = 512$

Fourier düzlemindeki frekanslar ve dalga boyları



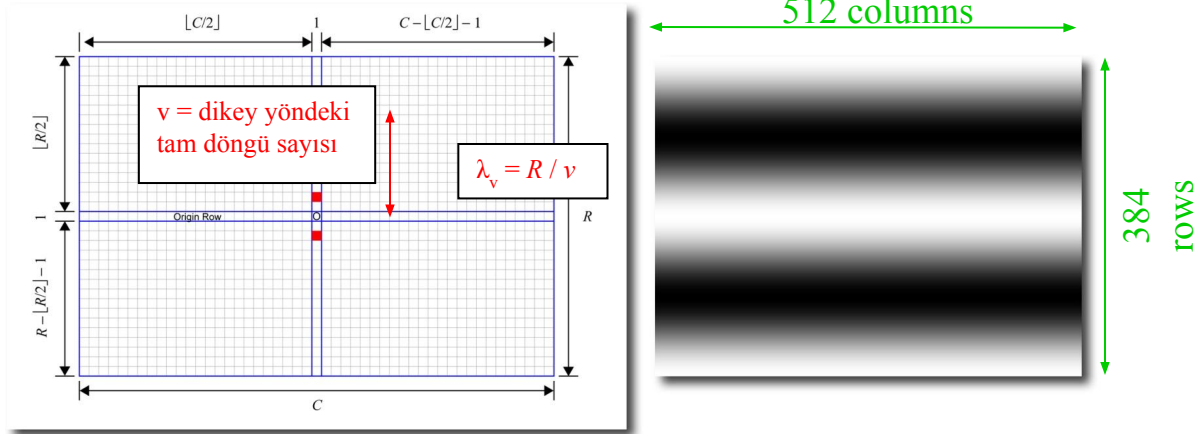
frekanslar: $(u, v) = (0, 1)$; dalga boyu: $\lambda_v = 384$

Fourier düzlemindeki frekanslar ve dalga boyları



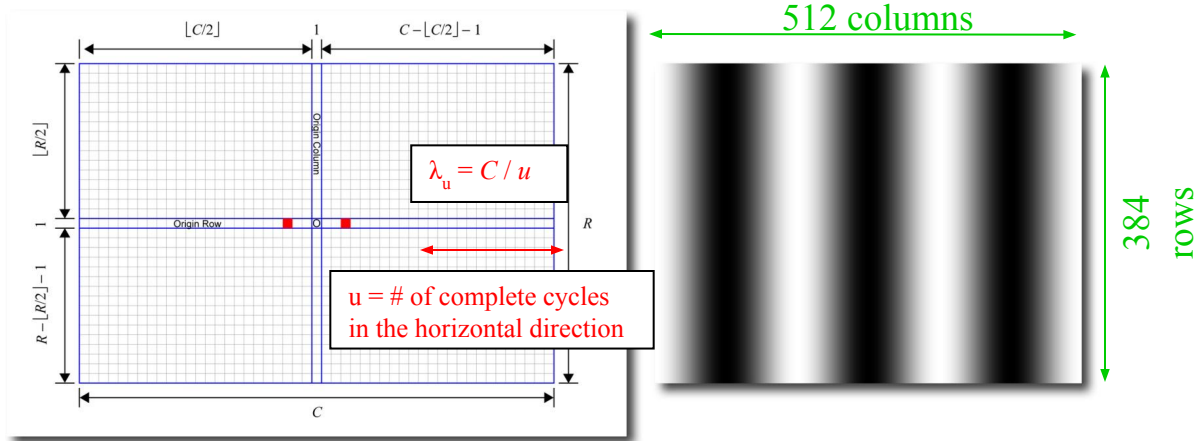
frekanslar: $(u, v) = (2, 0)$; dalga boyu: $\lambda_u = 256$

Fourier düzlemindeki frekanslar ve dalga boyları



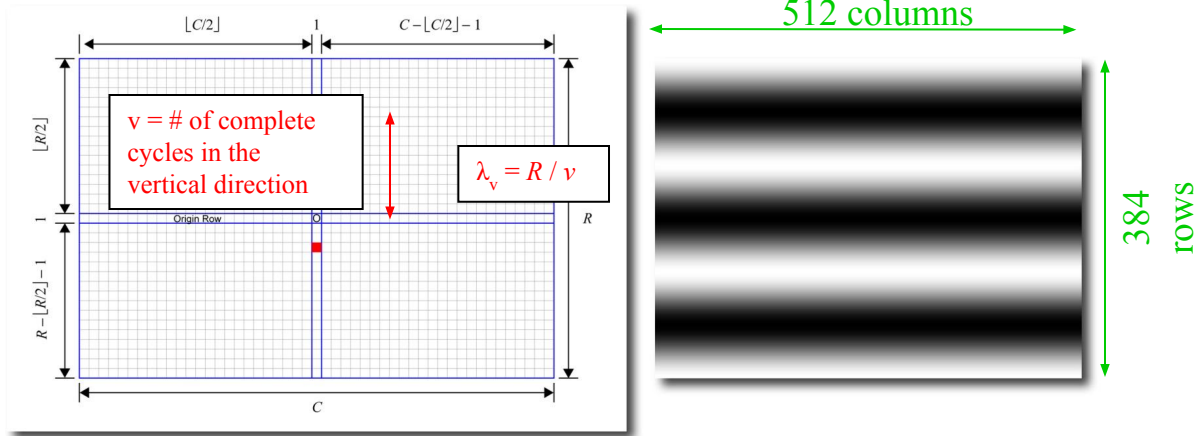
frekanslar: $(u, v) = (0, 2)$; dalga boyu: $\lambda_v = 192$

Fourier düzlemindeki frekanslar ve dalga boyları



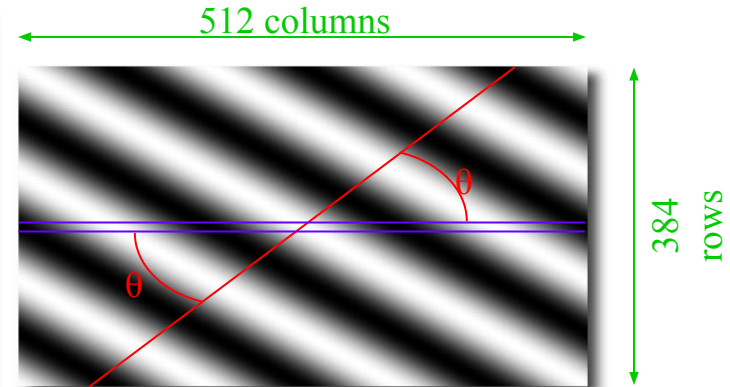
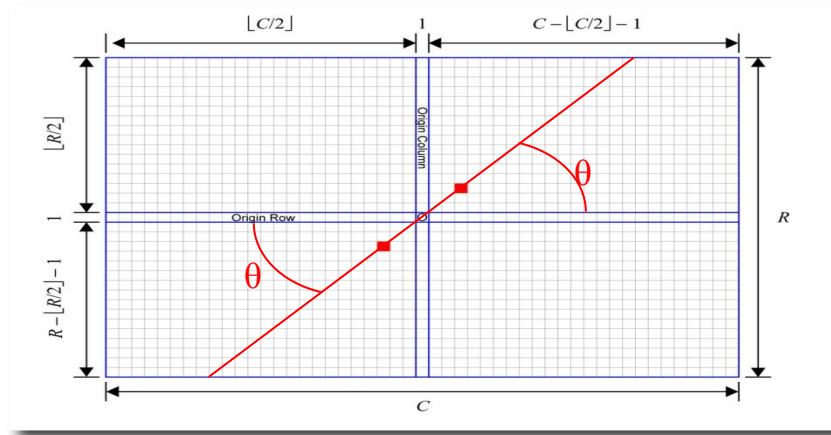
frequencies: $(u, v) = (3, 0)$; wavelength: $\lambda_u = 170.66$

Fourier düzlemindeki frekanslar ve dalga boyları



frequencies: $(u, v) = (0, 3)$; wavelength: $\lambda_v = 128$

Fourier düzlemindeki frekanslar ve dalga boyları



Frekanslar
 $(u, v) = (3, 3) \Rightarrow (\lambda_u, \lambda_v) = (170.66, 128)$

Fourier düzlemindeki frekanslar ve dalga boyları

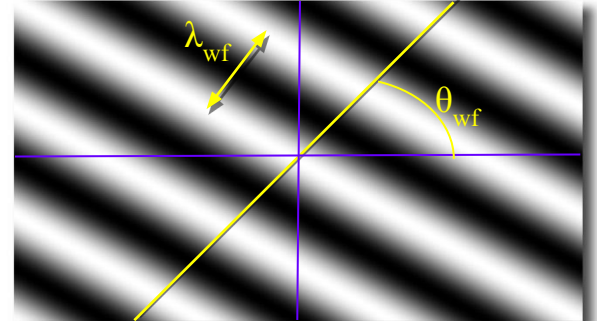
Genelde görüntüdeki dalga yönünün açısı $(v/R) / (u/C)$ dir

Bundan dolayı açı;

$$\theta_{wf} = \tan^{-1}\left(\frac{vC}{uR}\right),$$

Dalga boyu

$$\lambda_{wf} = \sqrt{\left(\frac{C}{u}\right)^2 + \left(\frac{R}{v}\right)^2},$$



Fourier düzlemindeki frekanslar ve dalga boyları

frekanslar: $(u, v) = (4, 3)$; dalga boyları: $(\lambda_u, \lambda_v) = (128, 128)$

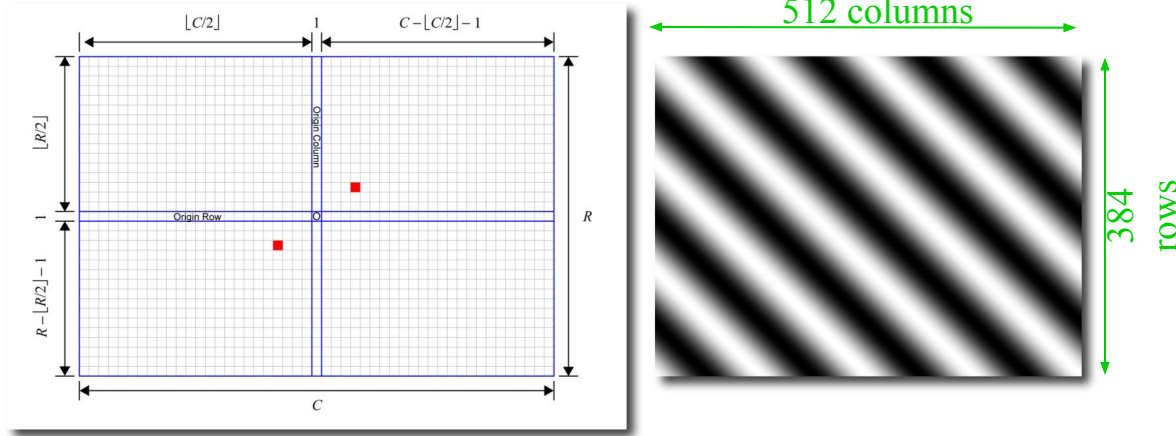
Dalga boyu

$$\lambda_{\text{wf}} = \sqrt{\left(\frac{512}{4}\right)^2 + \left(\frac{382}{3}\right)^2} = \sqrt{2 \cdot 128^2} = 128\sqrt{2},$$

Açısı

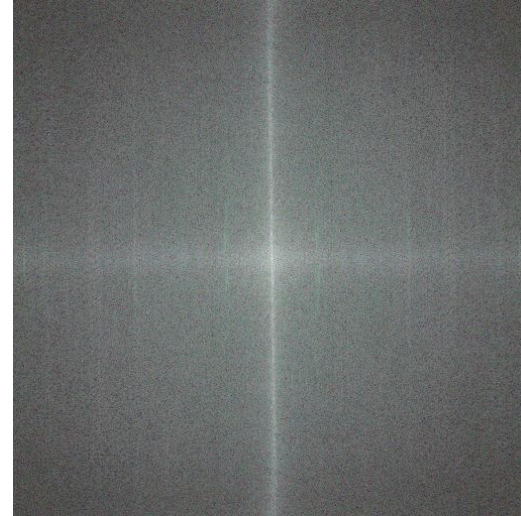
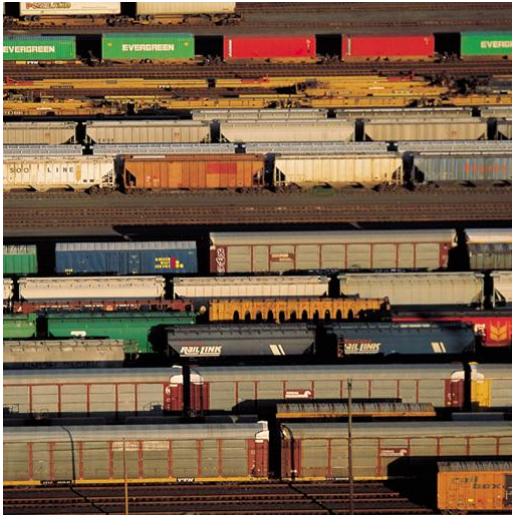
$$\theta_{\text{wf}} = \tan^{-1}\left(\frac{3 \cdot 512}{4 \cdot 384}\right) = \tan^{-1}\left(\frac{3 \cdot 4}{4 \cdot 3}\right) = \tan^{-1}(1) = 45^\circ,$$

Fourier düzlemindeki frekanslar ve dalga boyları

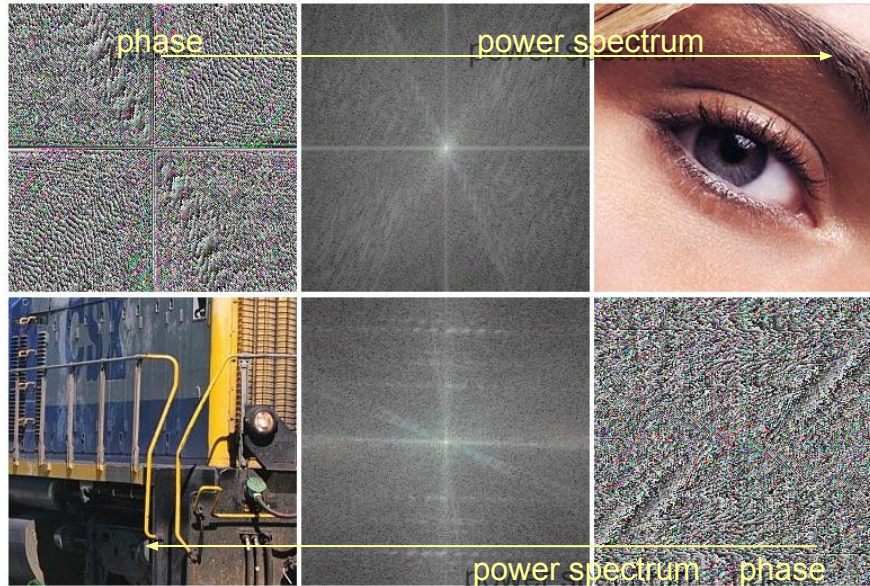


frekanslar: $(u, v) = (4, 3)$; dalga boyları: $(\lambda_u, \lambda_v) = (128, 128)$

Görüntünün Güç Spektrumu

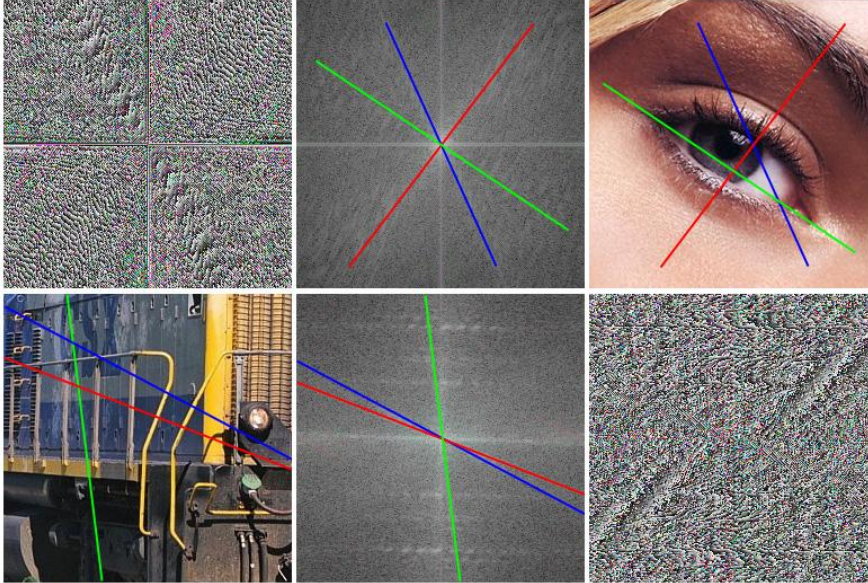


Görüntü ve FT arasındaki ilişki



Görüntü ve FT'deki özellikler

Spektrum
daki
çizgiler

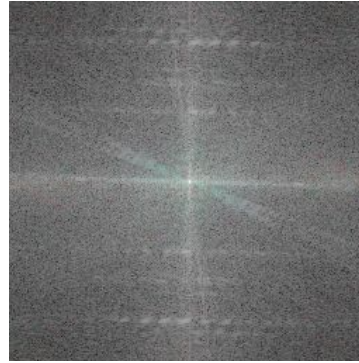


görüntüdeki
çizgilere
diktir

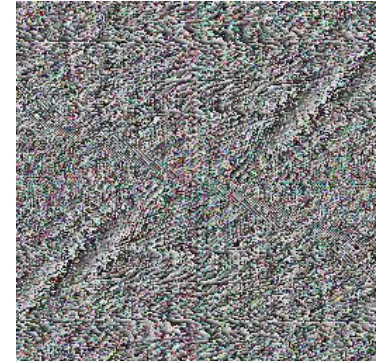
Hangisi daha fazla bilgi içerir?
Genlik mi, yoksa Faz mı?



Görüntü

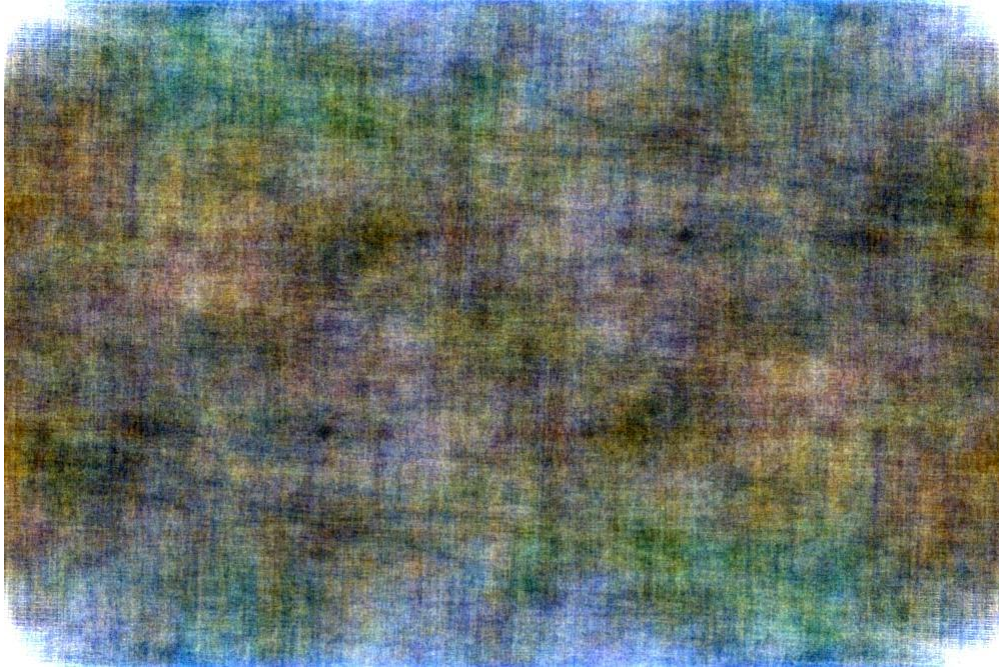


Amplitude



Phase

Sadece **genlik** kullanılarak yeniden elde etme



Sadece **faz** kullanılarak yeniden elde etme

