

In []:

```
from skimage.io import imread
import matplotlib.pyplot as pylab
import numpy as np
from skimage import data

from scipy import fftpack

pylab.figure(figsize=(15,10))
im = data.astronaut()
im = np.mean(im, axis=2) / 255
print(im.shape)

pylab.subplot(2,2,1), pylab.imshow(im, cmap='gray'), pylab.axis('off')
pylab.title('Original Image')

F1 = fftpack.fft2((im).astype(float))
F2 = fftpack.fftshift( F1 )

pylab.subplot(2,2,2), pylab.imshow( (20*np.log10( 0.1 + F2)).astype(int), cmap=pylab.cm.gray)

pylab.xticks(np.arange(0, im.shape[1], 25))
pylab.yticks(np.arange(0, im.shape[0], 25))
pylab.title('Original Image Spectrum')

# add periodic noise to the image
for n in range(im.shape[1]):
    im[:, n] += np.cos(0.1 * np.pi * n)

pylab.subplot(2,2,3), pylab.imshow(im, cmap='gray'), pylab.axis('off')
pylab.title('Image after adding Sinusoidal Noise')

F1 = fftpack.fft2((im).astype(float)) # noisy spectrum
F2 = fftpack.fftshift( F1 )
F2_org = F2.copy()

pylab.subplot(2,2,4)
pylab.imshow( (20*np.log10( 0.1 + F2)).astype(int), cmap=pylab.cm.gray)
pylab.xticks(np.arange(0, im.shape[1], 25))
pylab.yticks(np.arange(0, im.shape[0], 25))
pylab.title('Noisy Image Spectrum')
pylab.tight_layout()
pylab.show()
```

(512, 512)

/tmp/ipykernel_4933/1286852162.py:19: ComplexWarning: Casting complex values to real discards the imaginary part

```
pylab.subplot(2,2,2), pylab.imshow( (20*np.log10( 0.1 + F2)).astype(int), cmap=pylab.cm.gray)
```

/tmp/ipykernel_4933/1286852162.py:38: ComplexWarning: Casting complex values to real discards the imaginary part

```
pylab.imshow( (20*np.log10( 0.1 + F2)).astype(int), cmap=pylab.cm.gray)
```

Original Image



Original Image Spectrum

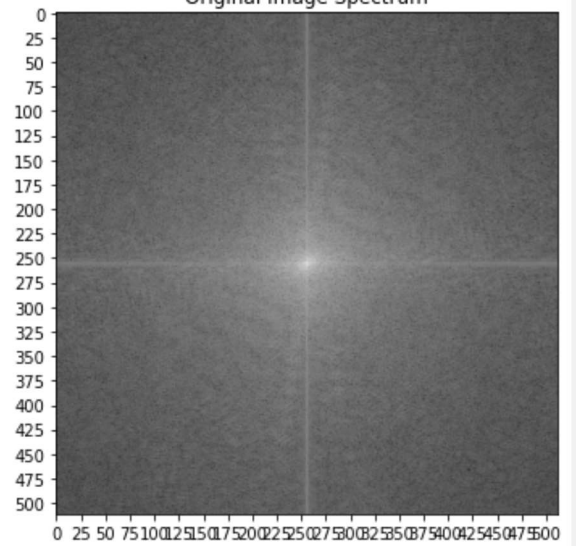
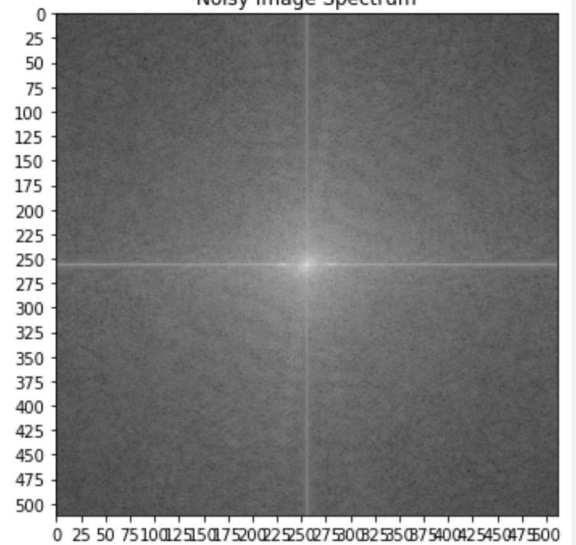


Image after adding Sinusoidal Noise



Noisy Image Spectrum

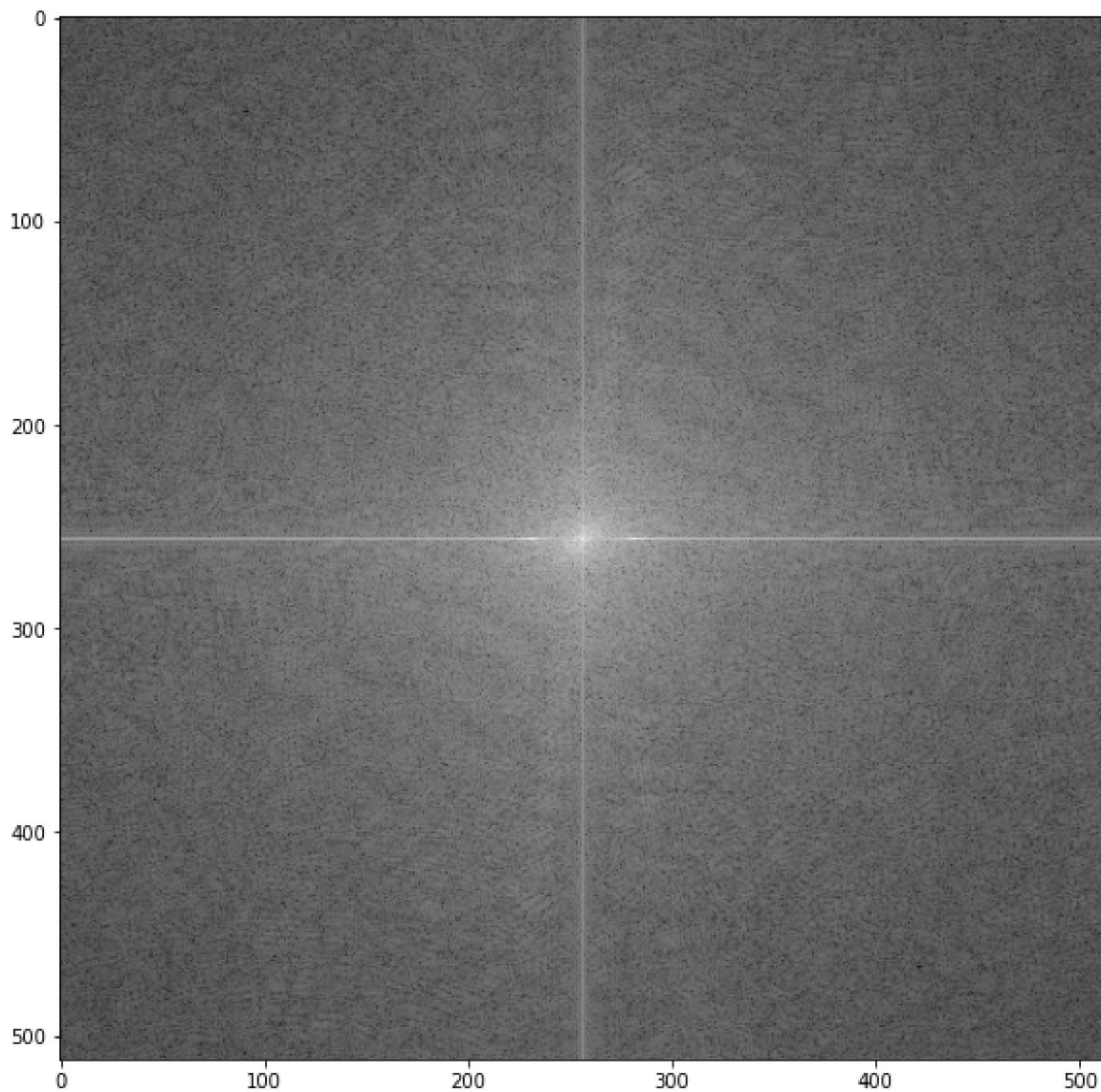


```
In [ ]:
pylab.figure(figsize=(15,10))
pylab.imshow( (20*np.log10( 0.1 + F2_org)).astype(int), cmap=pylab.cm.gray)
```

```
/tmp/ipykernel_4933/2774945732.py:2: ComplexWarning: Casting complex values to real discards
the imaginary part
```

```
pylab.imshow( (20*np.log10( 0.1 + F2_org)).astype(int), cmap=pylab.cm.gray)
```

```
Out[ ]: <matplotlib.image.AxesImage at 0x7f0189bd1160>
```



In []:

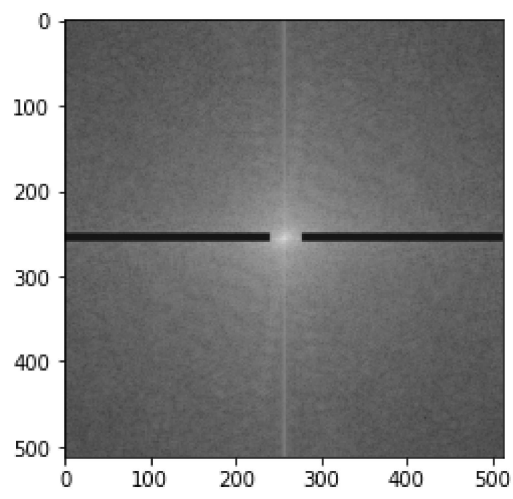
```
# eliminate the frequencies most likely responsible for noise (keep some low frequency components)
F2 = F2_org.copy()

F2[250:260,:240] = F2[250:260, 277:] = 0
pylab.imshow( (20*np.log10( 0.1 + F2)).astype(int), cmap=pylab.cm.gray)
im1 = fftpack.ifft2(fftpack.ifftshift( F2 )).real

pylab.figure(figsize=(15,10))
pylab.axis('off')
pylab.imshow(im1, cmap='gray')
pylab.show()
```

/tmp/ipykernel_4933/1029507954.py:5: ComplexWarning: Casting complex values to real discards the imaginary part

```
pylab.imshow( (20*np.log10( 0.1 + F2)).astype(int), cmap=pylab.cm.gray)
```



In []: