EXPERIMENT 7. IMAGE PROCESSING, 2D FFT, FILTERING, EDGE DETECTION

PART 2

LABORATORY REPORT
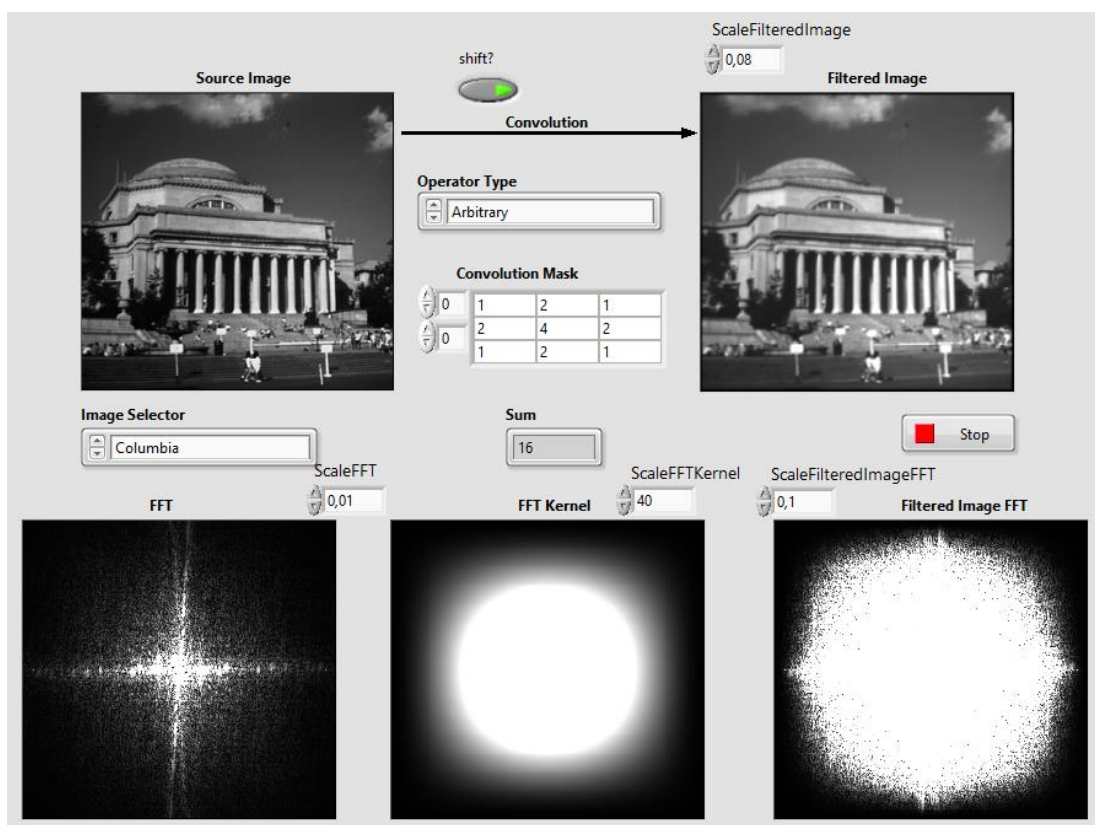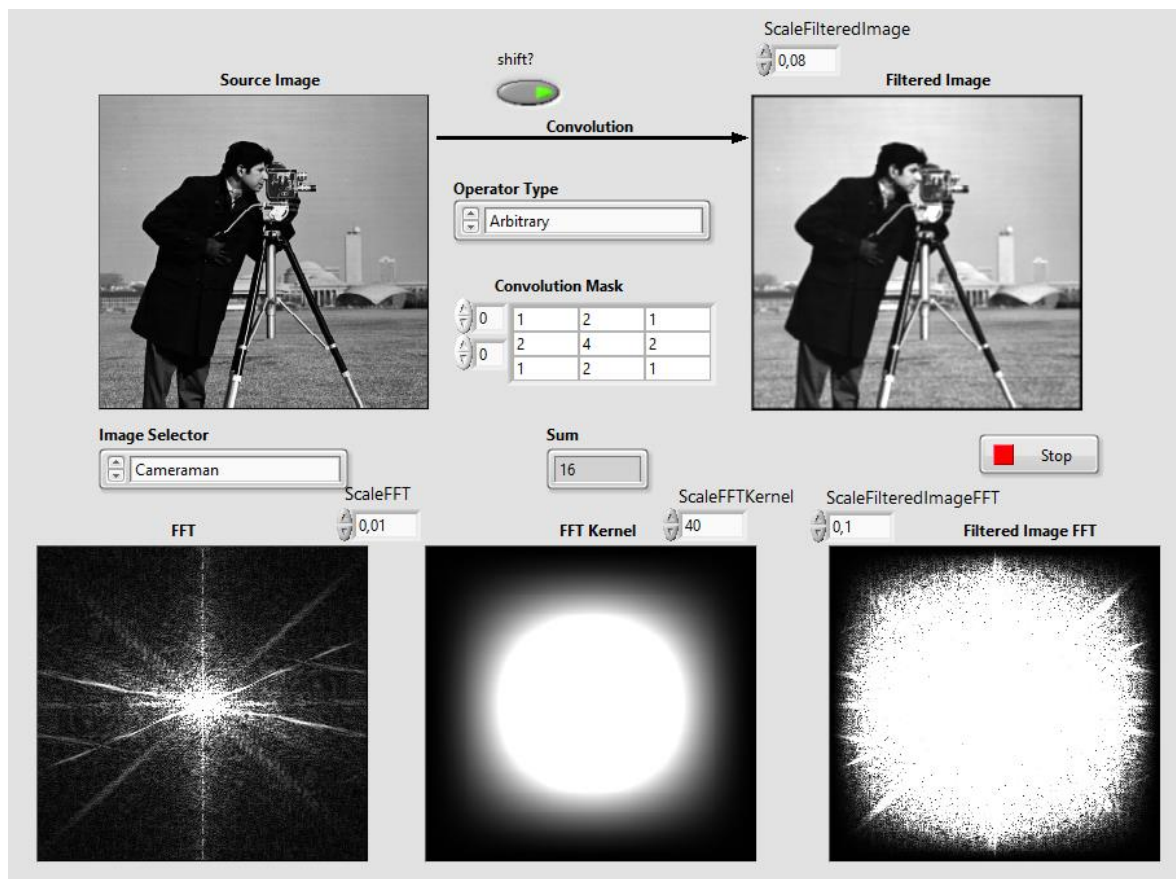
Student 1:Süleyman Emre Can-2093524
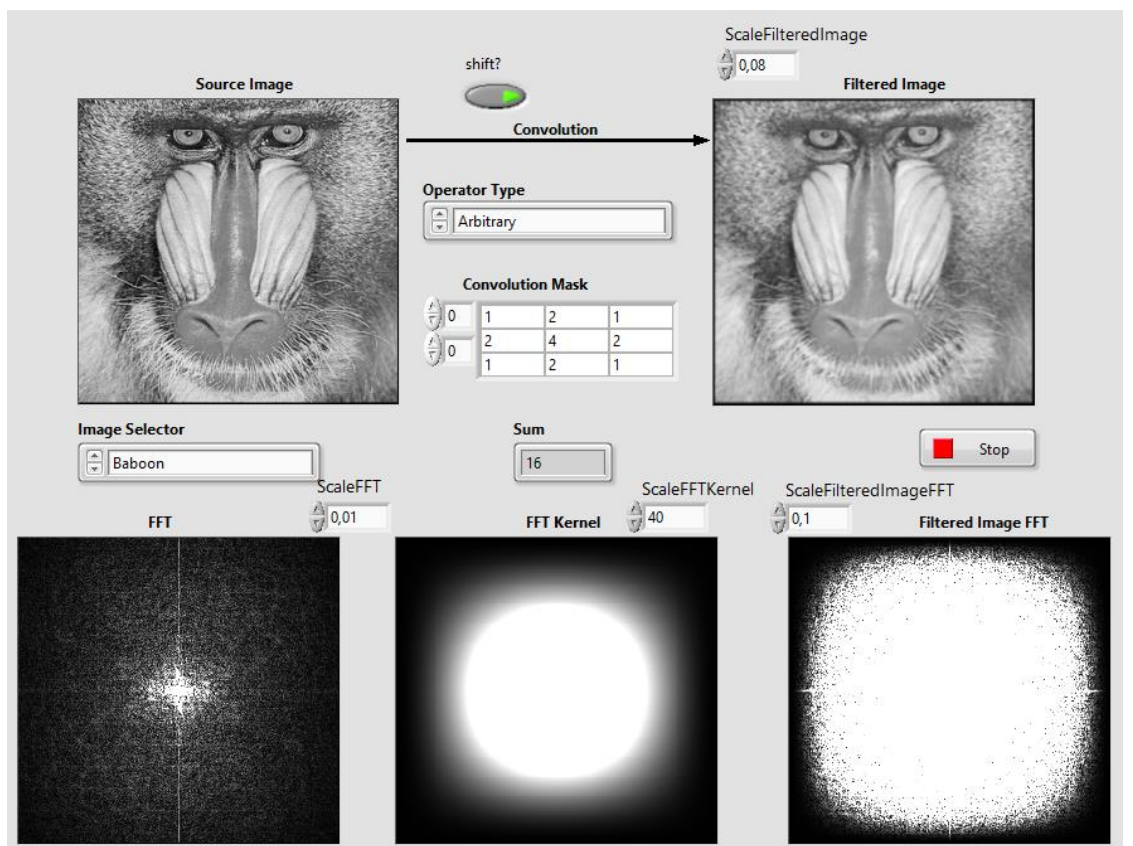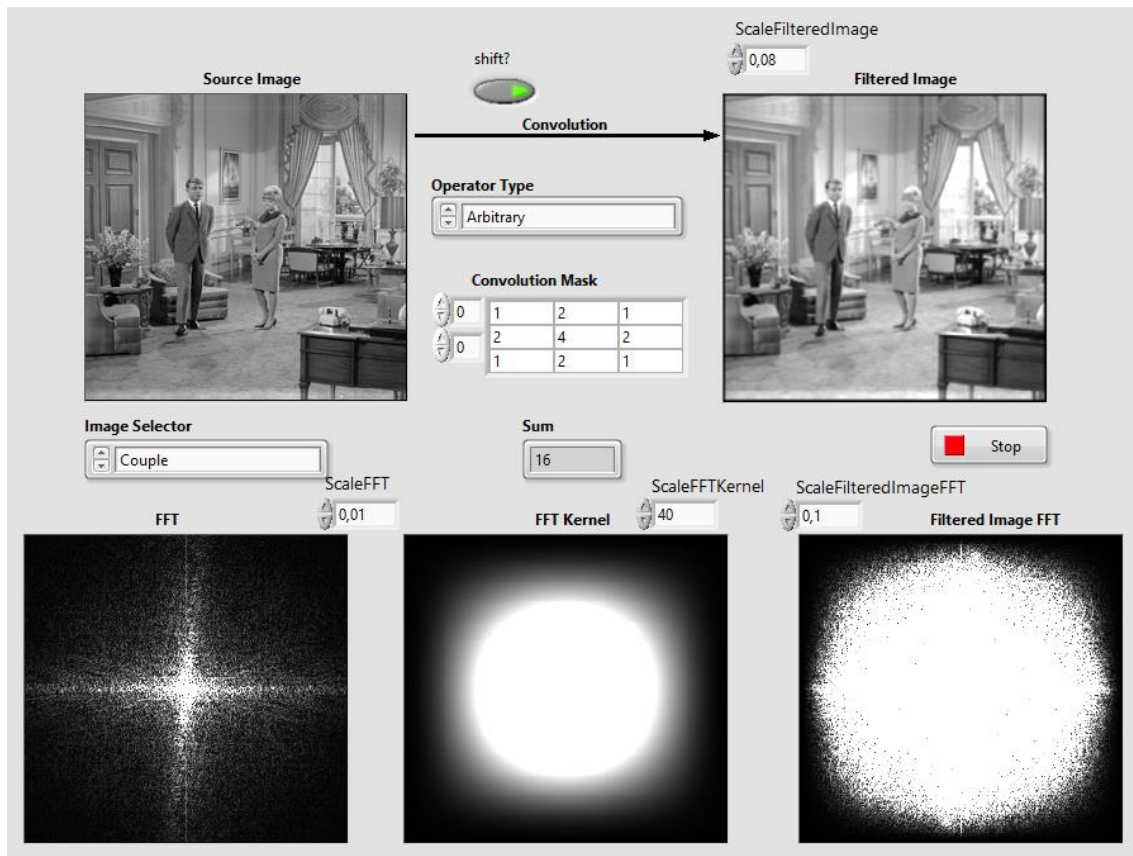**Student 2:Yekta Demirci-2093607**

Real-time Programming Tasks

Part A:

- *Add a scaling control for all the images in your block diagram for better visualization and preventing image clipping.*

b) Obtain the 2D Fourier transform of **cameraman** in order to visualize the low and high frequency components. You can try other image sources such as *"Baboon"*, *"Colombia"* and *"Couple"* in order to see the differences between frequency contents. **Comment on** each image and its frequency characteristics. ***Don't forget to attach all the images and their FFT magnitude spectra.***

EE 497 Real-time Applications of Digital Signal Processing

EE 497 Real-time Applications of Digital Signal Processing

It can be seen that low frequency components have similar magnitudes, distributions.

c) Obtain the phase components of cameraman. Assume that the magnitude components are one and use 2D ifft to reconstruct the image by using only the phase information as shown in Fig. 5. Comment on your findings. **Try magnitudes of FFT of one of other images** for the magnitude terms during the reconstruction. Can you obtain better reconstruction quality with this selection? ***Don't forget to attach the reconstructed images for both cases.***
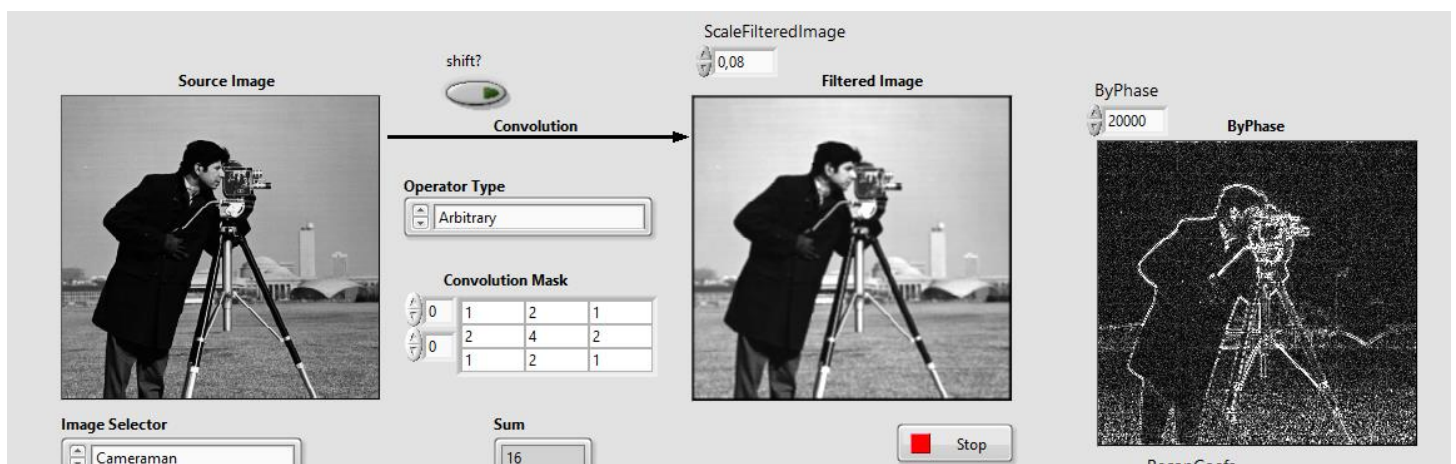

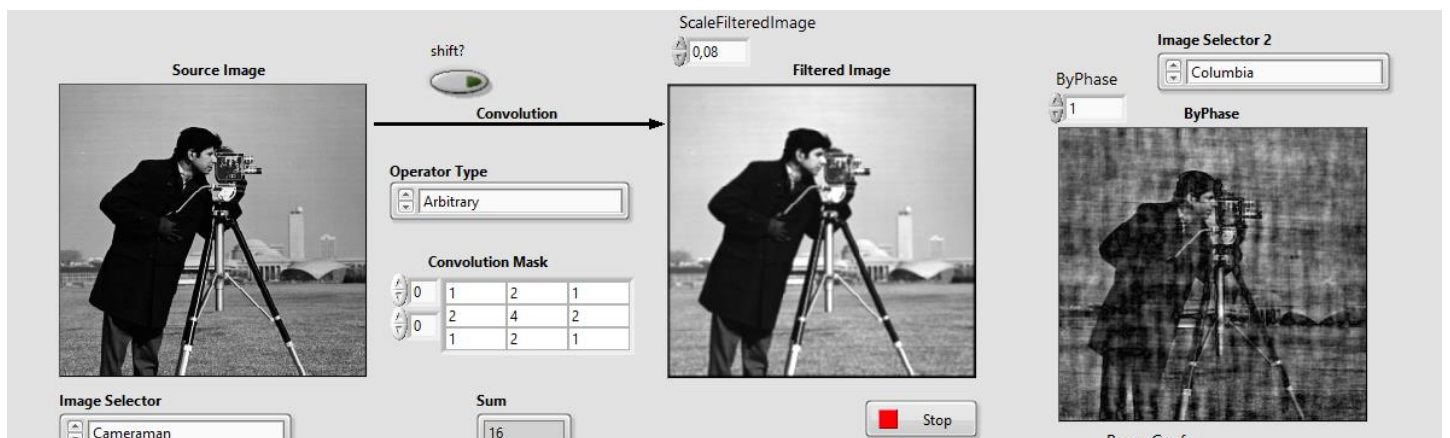Figure 1: Phase reconstruction with magnitude equal to 1

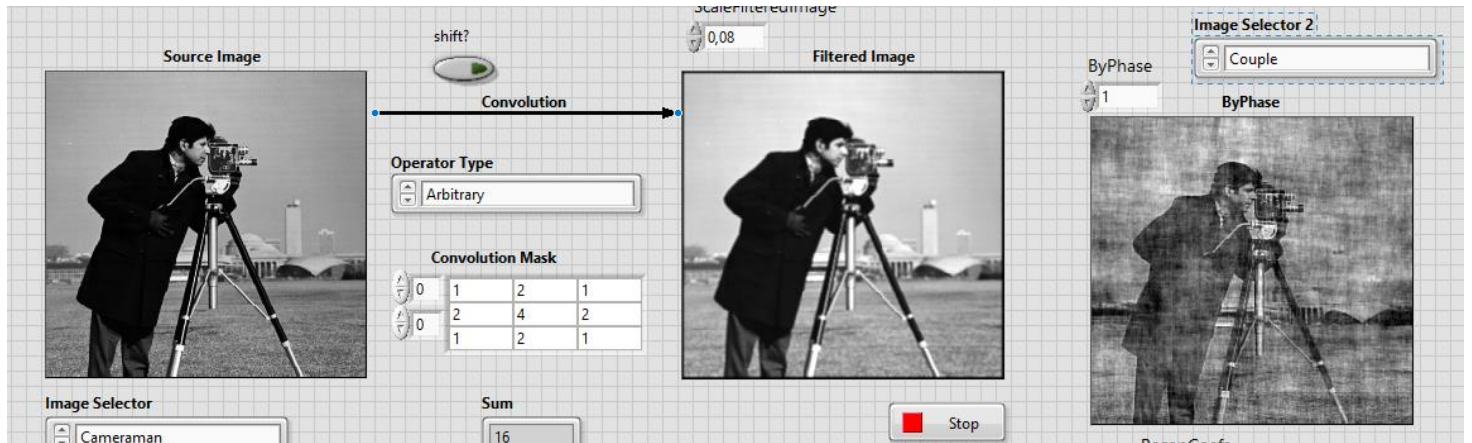Figure 2: Phase reconstruction with magnitude of Columbia Picture

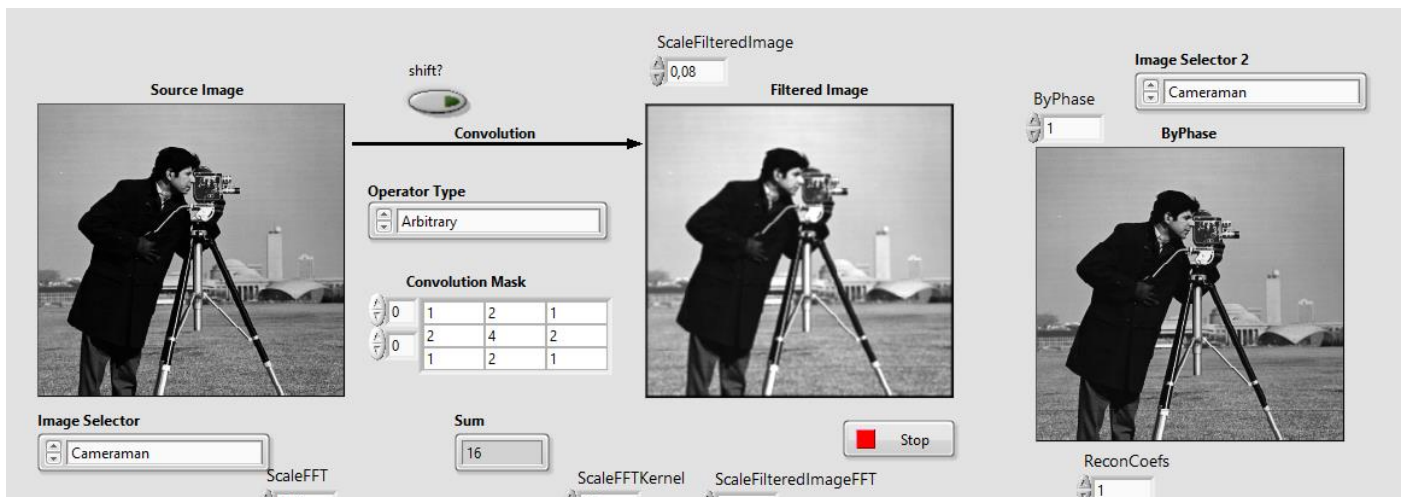*Figure 3: Phase reconstruction with magnitude of Couple Picture*

Figure 4: Phase reconstruction with magnitude of Cameraman Picture

Since the low-pass components are similar, when we use the original phase, we can still obtain the something to the original image.

EE 497 Real-time Applications of Digital Signal Processing

d) Increase the size of the Convolution Mask in Fig. 9 to 9x9. You can easily do that by enlarging the box with mouse and entering numerical values. Repeat *part e)* in *MATLAB* Tasks. In this case you only need to implement the filtering using *"convolution.vi"*. ***Don't forget to attach all the results.***
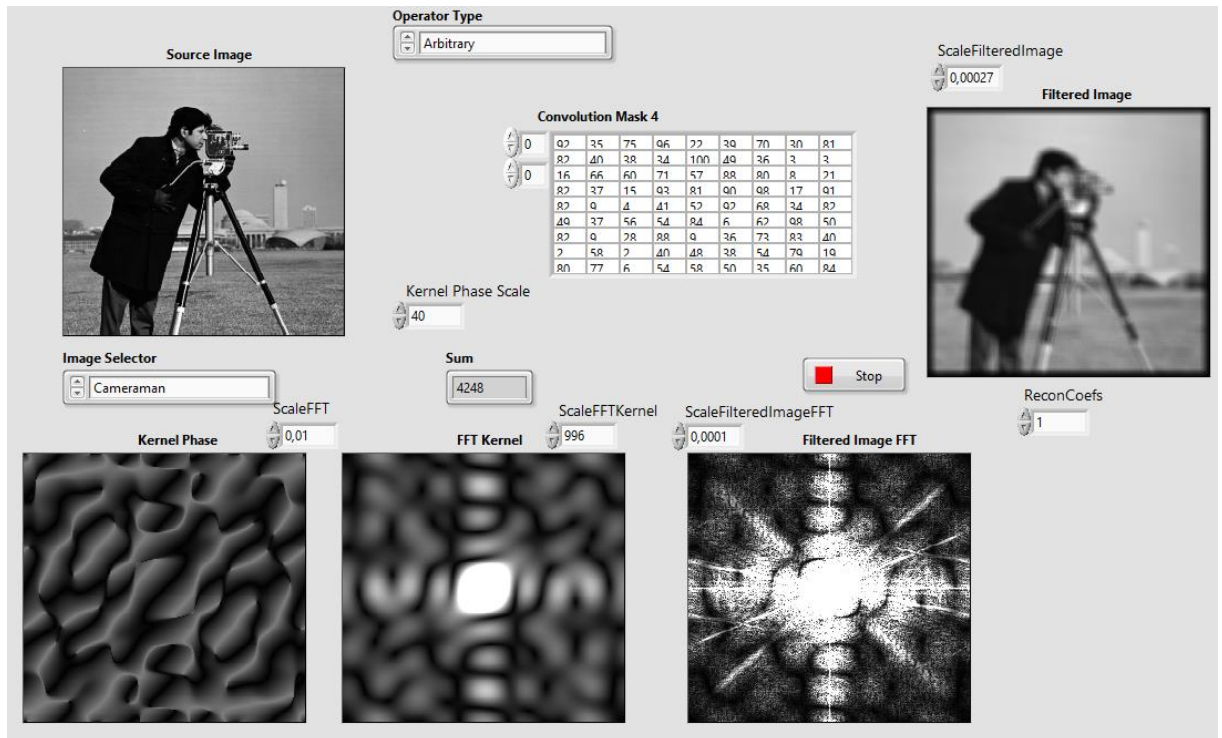
Since phase component is critical for reconstruction, distortion caused by non-linear phase filter effects the quality of reconstruction. Most of the image information is hidden in phase. When the phase is distorted, we cannot construct back the image as it was. Therefore, linear phase filters are important in order to construct back the image.

e) Repeat *part f)* in *MATLAB* Tasks. In this case, you can use the available image sources instead of *Lena*. Try all the images and comment on their reconstruction quality. **Try at least 2 different noise levels, one for low and the other for relatively high noise. You don't need to compute LSE in this part.** *Don't forget to attach all the results.*
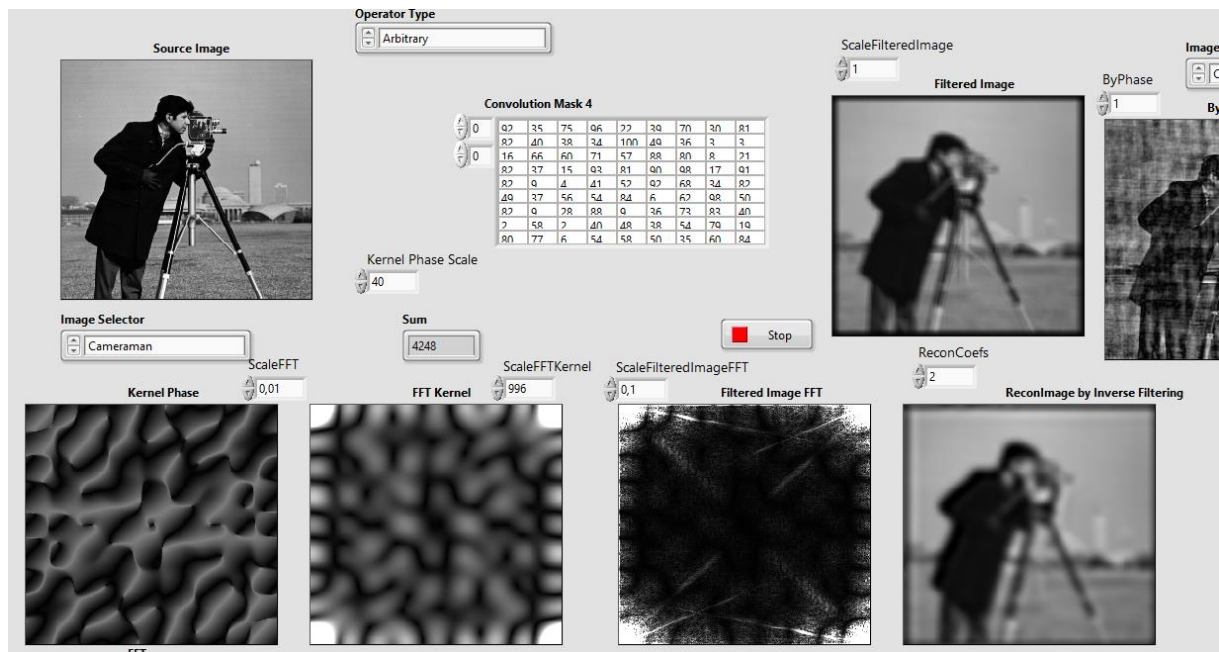

Figure 5:Recontruction by inververse filtering method(Bottom Right) w/noise std.dev=0.5

Figure 6:Recontruction by inververse filtering method w/noise std.dev=50

As the noise increases, reconstructed image quality decreases, as expected.