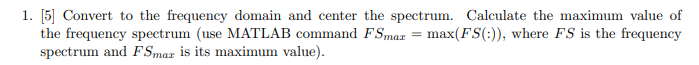
**ECE 7410/ENGI 9804 IMAGE PROCESSING AND APPLICATIONS**

**Assignment 2**

**STUDENT NAME:**

**NAYEM AL TAREQ : 202293442**

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A screenshot of a computer program

Description automatically generated





A screenshot of a computer

Description automatically generated

A close up of text

Description automatically generated

A screenshot of a computer program

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A screenshot of a computer

Description automatically generated

Noise\_function

A screenshot of a computer program

Description automatically generated

Output:

A screenshot of a computer

Description automatically generated



A screenshot of a computer code

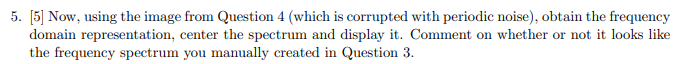
Description automatically generated

Output :

A screenshot of a computer

Description automatically generated

**Comment:** The noisy image displays a regular pattern of circular artifacts and blurring, resulting from the specific points where noise was added in the frequency domain. Despite this, the astronaut and rock formations remain visible, though less sharp than in the original image. The noise patterns create a grainy texture, disrupting the smoothness of the original image and degrading its overall quality. This demonstrates how frequency domain manipulations can significantly impact the spatial domain representation, introducing high-frequency components that manifest as artifacts and blurring, thereby emphasizing the importance of understanding these effects.



A screenshot of a computer

Description automatically generated

Output:

A screenshot of a computer

Description automatically generated

**Comment:** The frequency domain representation of the noisy spatial domain image shows distinct bright spots around the center, indicating periodic noise. These spots correspond to specific frequency components added to the image, matching the expected pattern from manually adding noise in the frequency domain. The centered spectrum clearly reveals these components, confirming the consistency between spatial domain manipulations and their frequency domain representations. This image closely resembles the manually created frequency spectrum, validating the effects of periodic noise and demonstrating the alignment between spatial and frequency domain alterations.

A white background with black text

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A screenshot of a computer

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A screenshot of a computer program

Description automatically generated

A computer code on a white background

Description automatically generated

a)Ideal



A screen shot of a computer

Description automatically generated

(b) Butterworth with order 4 (i.e. n=4)



A screenshot of a computer

Description automatically generated

c) Gaussian



A screenshot of a computer

Description automatically generated



A screenshot of a computer screen

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**a)Ideal Filter**



A screen shot of a computer

Description automatically generated

**b) Butterworth Filter**



A screenshot of a computer

Description automatically generated

c)Gaussian Filter



A screenshot of a computer

Description automatically generated

A close-up of a text

Description automatically generated

Solution:

A screenshot of a computer program

Description automatically generated

A screenshot of a computer

Description automatically generated



Solution:

The Ideal, Butterworth, and Gaussian band-reject filters each handle noise removal differently. The Ideal filter is very effective at removing specific frequencies but often introduces noticeable ringing artifacts due to its abrupt cutoff. The Butterworth filter provides a smoother transition, effectively reducing noise while minimizing artifacts, striking a balance between noise removal and image quality preservation. The Gaussian filter offers the smoothest transition, reducing noise with minimal artifacts and best preserving overall image quality. Thus, the Ideal filter is best for complete noise removal at the cost of artifacts, the Butterworth filter offers a good compromise, and the Gaussian filter provides the best overall performance with minimal artifacts.

Referance : Google, Chatgpt ,Matlab website,gemni .