

MAI572 Speech Processing & Recognition

Department of Computer Science, Christ University Central Campus

Lab Exercise II

Fourier Transform and Frequency Spectrum Analysis of Signals

This lab experiment aims to apply the Fourier Transform on various signals in the time domain and analyze its frequency spectrum using the Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT).

(1) Question 1

- (a) Generate a basic sinusoidal signal in the time domain.
(For example, you may generate a sine wave with a frequency of 5Hz, sampled at 1000Hz.)
- (b) Plot the time-domain waveform of the signal.
- (c) Compute the Discrete-Time Fourier Transform (DTFT) and plot the continuous frequency spectrum.
- (d) Compute the Discrete Fourier Transform (DFT) and plot the discrete frequency spectrum.

(2) Question 2

- (a) Generate a composite signal by adding two or more sinusoidal signals of different frequencies and amplitudes.
- (b) Plot the time-domain waveform of the composite signal.
- (c) Compute the Discrete-Time Fourier Transform (DTFT) and plot the continuous frequency spectrum.
- (d) Compute the Discrete Fourier Transform (DFT) and plot the discrete frequency spectrum.

(3) Question 3

- (a) Generate an exponentially decaying signal.
 - (b) Plot the time-domain waveform.
 - (c) Compute the Discrete-Time Fourier Transform (DTFT) and plot the continuous frequency spectrum.
 - (d) Compute the Discrete Fourier Transform (DFT) and plot the discrete frequency spectrum.
 - (e) Analyze the relationship between the time-domain waveform and the frequency-domain representation.
- (4) Question 4
- (a) Generate an exponentially decaying signal.
 - (b) Plot the time-domain waveform.
 - (c) Compute the Discrete-Time Fourier Transform (DTFT) and plot the continuous frequency spectrum.
 - (d) Compute the Discrete Fourier Transform (DFT) and plot the discrete frequency spectrum.
 - (e) Analyze the relationship between the time-domain waveform and the frequency-domain representation.

Write an inference on the frequency domain analysis of various signals using DTFT and DFT.

Evaluation Rubrics:-

- (1) Implementation: 5 marks.
- (2) Complexity and Validation: 3 marks.
- (3) Documentation & Writing the inference: 2 marks

Submission Guidelines:-

- Generate the single .pdf file for the given questions separately.
- Upload the pdf files in Google Classroom on or before the deadline mentioned.