Chart, funnel chart

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| --- | --- |
| Course Number | ELE532 |
| Course Title | Signals and Systems I |
| Semester/Year | F2022 |
| Instructor | Dimitri Androutsos |
| TA Name | Sarina Taki |
| Section No. | 08 |
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|  |  |  |
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# Introduction

The objective of this lab is to learn how to analyze, observe and study frequency-

domain characteristics of time waveforms

# Lab Results



Signal X(t)’s code and graph:

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Chart, line chart

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X(t)\*X(t):



Chart, line chart

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Full table of values of Zf provided in the excel sheet submitted with the report



Z(t):

Chart, diagram

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Chart

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In A1, the graph was the result of x(t) was convoluted with itself where in A4, the 3rd graph was the result of z(w) which is x(w) multiplied by x(w), x(w) being the fourier transform of x(t) to the frequency domain. A1 graph and A4 3rd graph are identical because of the property that states that the product of 2 functions in frequency domain is equal to the convolution of the same 2 functions in time domain. X(t)\*X(t) ⬄ X(w)X(w).

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X(t) but pulse length equal 5 instead of 10 results:

Generating function X5(t) and the results:

Text

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Chart

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Description automatically generated

Transforming X5(t) to X5(w):

A picture containing graphical user interface

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Chart, line chart

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Chart, line chart

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X(t) but pulse length equal 25 instead of 10 results:

Generating function X25(t) and the results:Text, letter

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Description automatically generatedChart, line chart

Description automatically generated

Transforming X25(t) to X25(w):

Text, letter

Description automatically generated

Chart

Description automatically generated

Chart, line chart

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The graphs have similar shapes however they have different time and magnitude scaling and since the original function was time scaled in A5. This is the time scaling property which states:

X(t/a) ⬄ a X (a ω)

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Chart, line chart

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A picture containing chart

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The property demonstrated is the Frequency shift property which states: X(t-a) ⬄e­­-jwaX(w)

Since cosine can be expressed in eulers form the property still holds. The graphs are shifted versions of those in A3. First exponential is ejwt so it was shifted by pi/3 as w= pi/ 3, second exponential is e-jwt so it was shifted by -pi/3 as w= -pi/ 3 and third one is 1st and 2nd graphs added since cosine(wt) can be expressed as ejwt + e-jwt where w= pi/ 3 explaining the existence of 2 peaks.



Original signals:

A screenshot of a computer

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Chart

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A screenshot of a computer

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Graphical user interface

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Text

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Graphical user interface, chart

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Diagram

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