Table, letter

Description automatically generated

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1. The Fourier Transform and its Properties

A1.

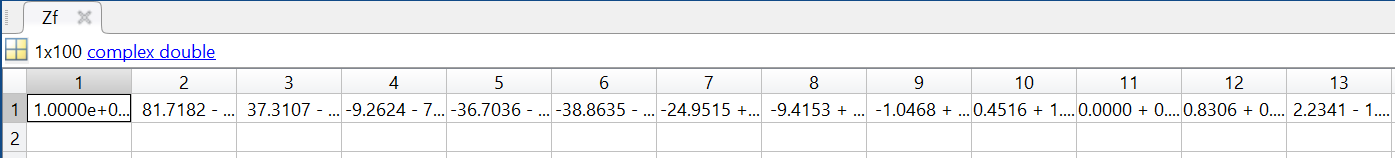
Diagram

Description automatically generated

A2.

A screenshot of a computer

Description automatically generated with medium confidence



Full values from table can be seen by running the code and expanding each table.

A3.

A screenshot of a computer

Description automatically generated with medium confidence

Chart, line chart

Description automatically generated

A4.

Text

Description automatically generated

Chart

Description automatically generated

Z(w) graph generated by the code above.

Chart, line chart

Description automatically generated

Z(t) graph generated by the code above.

The graphs generated would be identical to the graph computed in part A1. We have thus proved the convolution property, as both z(t) = x(t) \* x(t) and Z(w) = X(w)X(w) are both true and identical.

A5.

Text

Description automatically generated

Graphical user interface

Description automatically generated

Graph with a pulse width of 25 generated by code above.

Chart, line chart

Description automatically generated

Graph with a pulse width of 5 generated by code above.

As the pulse width is increased or decreased, the amplitude of the resulting graph will be scaled by that factor. This showcases the time-scaling property the transform.

A6.

Text

Description automatically generated

Chart, line chart

Description automatically generated

Generated graph of Wc from code above.

Chart, line chart

Description automatically generated

Generated graph of Wnegative from code above.

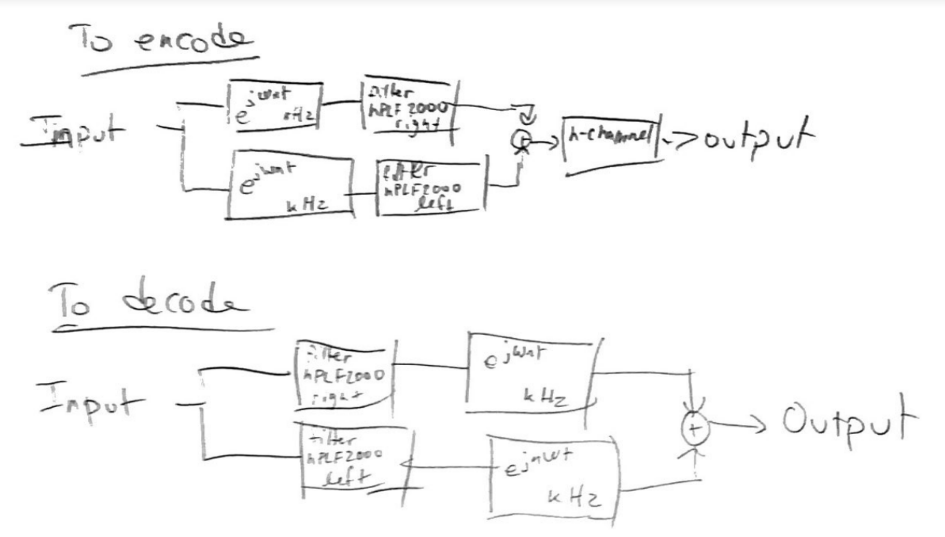
Chart, line chart

Description automatically generated

Generated graph of Wpositive of code above.

From these graphs, we can determine that multiplication of a complex exp. With our function will shift our resulting signal. This showcases the frequency shifting property of the transform. In the case of the Wc graph, cosine is split into two complex exp. Functions, and they are halved (Euler’s identity), so we end up with two “spikes” that are half of the original amplitude.

1. Application of the Fourier Transform



Block diagram of encoding/decoding.

B1.

Table

Description automatically generated with medium confidence

MagSpectrum code. Given in the lab manual.

Text

Description automatically generated

Osc code. Given in the lab manual.

Graphical user interface, text, application

Description automatically generated with medium confidence

Graphical user interface, text, application

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Code to generate audio signals.

Chart

Description automatically generated

Chart

Description automatically generated

Chart

Description automatically generated

Chart

Description automatically generated

Chart

Description automatically generated

Chart

Description automatically generated

Chart

Description automatically generated

Chart, line chart

Description automatically generated

Chart

Description automatically generated

Chart, histogram

Description automatically generated

Chart

Description automatically generated

