MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA

DEEMED TO BE UNIVERSITY

(Declared under Distinct Category by Ministry of Education, Government of India)

NAAC ACCREDITED WITH A++ GRADE

DEPARTMENT OF ELECTRONICS ENGINEERING

2023-2024

A SKILL BASED MINI PROJECT

REPORT

"A GUI model in MATLAB to display various transforms of input waveforms"

Software Lab (2140414)

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS ENGINEERING

SUBMITTED BY:
RATNESH ASATI
(0901EC221087)

SUBMITTED TO:
DR. SHUBHI KANSAL

CERTIFICATE

This is to certify that the mini project report entitled **"Create a GUI model in MATLAB to display various transforms (e.g. Fourier, Laplace) of input waveforms"** submitted by RATNESH ASATI has been carried out under the guidance of Dr. SHUBHI KANSAL, Electronics Engineering, Madhav Institute of Technology & Science, Gwalior. The project report is approved for submission requirement for Mini Project in 4th semester in Electronics Engineering, from Madhav Institute of Technology & Science, Gwalior (M.P).

SUBMITTED TO:
Dr. SHUBHI KANSAL
(Department Of Electronics Engineering)

SUBMITTED BY:
RATNESH ASATI
(0901EC221087)

DECLARATION

I hereby declare that the project work entitled **"Create a GUI model in MATLAB to display various transforms (e.g. Fourier, Laplace) of input waveforms"** submitted to the Madhav Institute of Technology & Science Gwalior, is a record of an original work done by me under the guidance of Dr. SHUBHI KANSAL, Department of Electronics Engineering.

The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

RATNESH ASATI

Date : 24/04/2024

Place : MITS Gwalior

ACKNOWLEDGEMENT

We would like to express our gratitude towards **Dr. SHUBHI KANSAL**, for his support in accomplishment of our project on **"Create a GUI model in MATLAB to display various transforms (e.g. Fourier, Laplace) of input waveforms".**

I would like to extend my deep appreciation to all my group members, without their support and coordination we would not have been able to complete this project.

Finally, as one of the team members, I would like to appreciate all my group members for their support and coordination, I hope we will achieve more in our future endeavours.

"A[pu]GUI model in MATLAB to display various transforms of input waveforms"

Introduction:

MATLAB stands for Matrix Laboratory. It is a high-performance language that is used for technical computing.
It allows matrix manipulations, plotting of functions, implementation of algorithms and creation of user interfaces.
It is both a programming language as well as a programming environment. It allows the computation of statements in the command window itself.

MATLAB provides command for working with transforms, such as the Laplace and Fourier transforms. Transforms are used in science and engineering as a tool for simplifying analysis and look at data from another angle.

For example, the Fourier transform allows us to convert a signal represented as a function of time to a function of frequency. Laplace transform allows us to convert a differential equation to an algebraic equation.

MATLAB provides the laplace, fourier and fft commands to work with Laplace, Fourier and Fast Fourier transforms.

A graphical user interface (GUI) is a visual interface to a program. A good GUI can make applications more comfortable to use by providing them with a consistent appearance and with intuitive controls such as pushbuttons, edit boxes, list boxes, sliders, and menus.

How does Graphical User Interface Work?

A graphical user interface provides the client with a familiar environment in which to work. It contains push buttons, toggle buttons, lists, menus, text boxes, etc. GUIs are harder for the programmer because a GUI-based application must be prepared for mouse clicks (or possibly keyboard input) for any GUI item at any time. Such data are known as events, and a program that responds to events is said to be event-driven.

"A[pu]GUI model in MATLAB to display various transforms of input waveforms"

The Laplace Transform

The Laplace transform of a function of time f(t) is given by the following integral −

$$L\{f(t)\} = \int_0^\infty f(t).e^{-st}dt$$

Laplace Transform

Laplace transform is also denoted as transform of f(t) to F(s). You can see this transform or integration process converts f(t), a function of the symbolic variable t, into another function F(s), with another variable s.

Laplace transform turns differential equations into algebraic ones. To compute a Laplace transform of a function f(t), write –

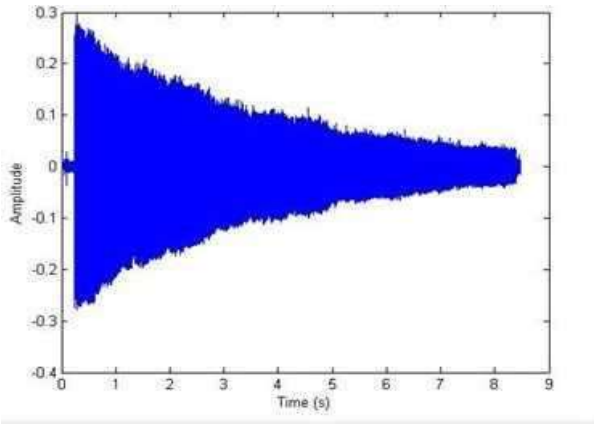
SYNTAX: laplace(f(t))

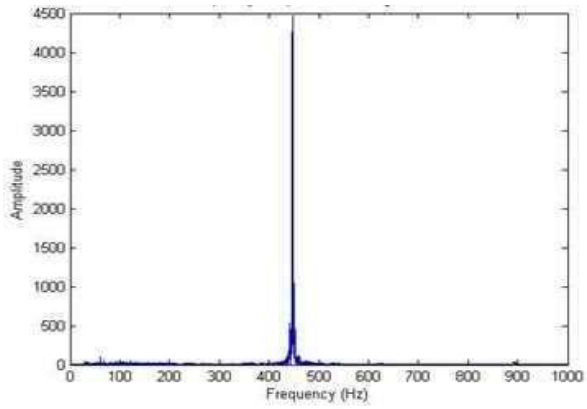
The Fourier Transforms

Fourier Transform is a mathematical model which helps to transform the signals between two different domains, such as transforming signal from frequency domain to time domain or vice versa. Fourier transform has many applications in Engineering and Physics, such as signal processing, RADAR, and so on. Fourier transforms commonly transforms a mathematical function of time, f(t), into a new function, sometimes denoted by or F, whose argument is frequency with units of cycles/s (hertz) or radians per second. The new function is then known as the Fourier transform and/or the frequency spectrum of the function f.

Thus, the Fourier transform of a function f(x) is given by:

$$f(x) = \int_{-\infty}^{\infty} F(k) e^{2\pi i k x} dk$$
$$F(k) = \int_{-\infty}^{\infty} f(x) e^{-2\pi i k x} dx$$





Code:

```
function waveform_transform_gui
    % Create figure and axes
    fig = uifigure('Name', 'Waveform Transform GUI');
    ax_waveform = uiaxes(fig, 'Position', [50, 300, 300, 200]);
    ax_fourier = uiaxes(fig, 'Position', [400, 300, 300, 200]);
    ax_laplace = uiaxes(fig, 'Position', [750, 300, 300, 200]);

    % Create text label
    uilabel(fig, 'Position', [50, 250, 300, 20], 'Text', 'Enter waveform (use comma-separated values):');

    % Create text input field
    txt_input = uieditfield(fig, 'text', 'Position', [50, 220, 300, 20], 'Value', '');

    % Create button
    btn_transform = uibutton(fig, 'push', 'Position', [50, 180, 100, 30], 'Text', 'Transform', 'ButtonPushedFcn', @(btn,event)
transformWaveform(txt_input.Value, ax_waveform, ax_fourier, ax_laplace));

    function transformWaveform(input, ax_waveform, ax_fourier, ax_laplace)
        % Convert input string to array
        waveform = str2double(strsplit(input, ','));

        % Plot waveform
        plot(ax_waveform, waveform);
        title(ax_waveform, 'Input Waveform');
        xlabel(ax_waveform, 'Time');
        ylabel(ax_waveform, 'Amplitude');

        % Compute Fourier transform
        fourier_transform = fft(waveform);
        freq = linspace(0, 1, length(fourier_transform));

        % Plot Fourier transform
        plot(ax_fourier, freq, abs(fourier_transform));
        title(ax_fourier, 'Fourier Transform');
        xlabel(ax_fourier, 'Frequency');
        ylabel(ax_fourier, 'Amplitude');

        % Compute Laplace transform
        laplace_transform = laplace(waveform);
        t = linspace(0, length(waveform), length(laplace_transform));

        % Plot Laplace transform
        plot(ax_laplace, t, laplace_transform);
        title(ax_laplace, 'Laplace Transform');
        xlabel(ax_laplace, 'Real');
        ylabel(ax_laplace, 'Imaginary');
    end
end
```

Conclusion

In conclusion, The Fourier transform is one of the most useful mathematical tools for many fields of science and engineering. The Fourier transform has applications in signal processing, physics, communications, geology, astronomy, optics, and many other fields. This technique transforms a function or set of data from the time or sample domain to the frequency domain. This means that the Fourier transform can display the frequency components within a time series of data. The Discrete Fourier Transform (DFT) transforms discrete data from the sample domain to the frequency domain. The Fast Fourier Transform (FFT) is an efficient way to do the DFT, and there are many different algorithms to accomplish the FFT. Matlab uses the FFT to find the frequency components of a discrete signal

In MATLAB, you can use the Laplace function to calculate the Laplace transform of a function. We can calculate the Laplace transform w.r.t to the default transformation variable‘s’ or the variable we define as the transformation variable.