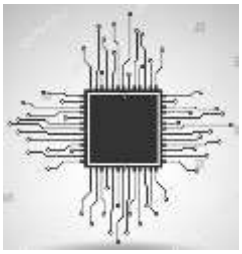


Visvesvaraya National Institute of Technology, Nagpur

Department of Electrical Engineering

Programming Techniques and Simulation Lab

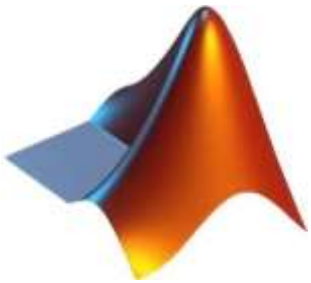
PCB Design Tool App:

All-in-one PCB trace calculation and analysis tool

Submitted by:

Lakshit Trivedi

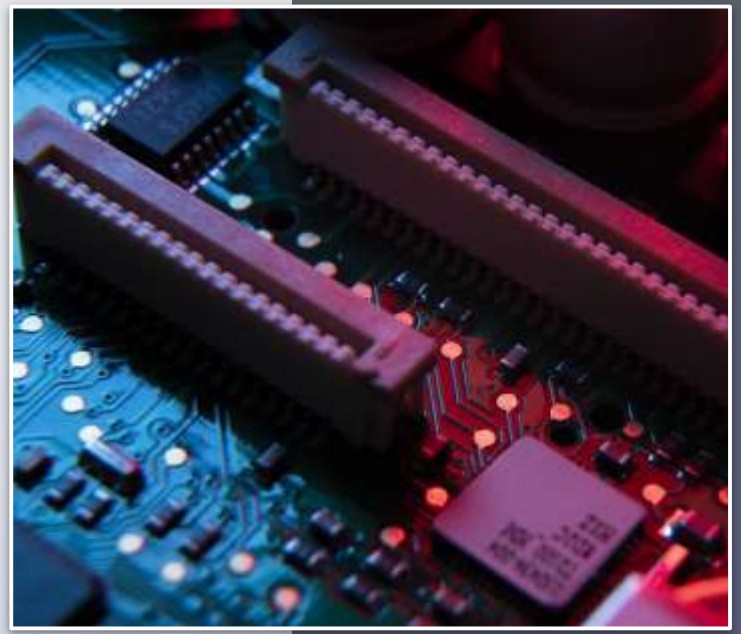
Roll No.: BT23EEE025



This MATLAB-based PCB Design Tool simplifies trace width calculations, unit conversions, and high-frequency analysis.
It provides a user-friendly interface for electronics engineers, PCB designers, and VLSI professionals.

PCB DESIGN TOOL APP

LAKSHIT TRIVEDI. BT23EEE025



Brief Overview of the App

- A MATLAB-based tool designed to streamline PCB trace design and analysis. Offers an intuitive UI to calculate trace width, perform unit conversions, and analyze high-frequency electrical properties.
- Supports both **microstrip** and **stripline** configurations.
- Includes advanced features like **skin effect modeling**, **resistance calculation**, and **power loss estimation**.
- Bridges theoretical concepts with practical PCB layout requirements.

Purpose of this App

- Modern electronic circuits, especially at high frequencies, require precise PCB trace calculations.
- Manual methods can be time-consuming and prone to human error.
- The app automates essential design tasks—improving accuracy and saving time.
- Developed as part of an academic project to merge theory with hands-on learning.
- Designed to enhance productivity and reduce design flaws in real-world projects.

Target Users and Future Applications

- **PCB Designers** – to quickly compute trace parameters during layout development.
- **Electronics Engineers** – to evaluate signal integrity, resistance, and current handling.
- **VLSI Professionals** – for modeling high-speed interconnect behavior.
- **Students & Educators** – as a teaching and learning aid for PCB and transmission line concepts.
- Useful across academic, hobbyist, and industrial settings.

Design Motivation & Challenges

- **Complex Calculations**: PCB trace width and resistance calculations, especially at high frequencies, involve complicated formulas and can be error-prone when done manually.
- **Unit Inconsistencies**: Designers often work with various units (mm, mils, oz/sq ft), leading to confusion and inaccuracies during conversions.
- **Overlooked High-Frequency Effects**: Most basic tools do not consider effects like skin depth, which are critical in high-frequency designs.
- **No Beginner-Friendly All-in-One Tool**: Available tools are either too advanced or limited, creating a gap for students, beginners, and practical engineers who need a simplified but comprehensive solution.

Objectives of the Application

- **Accurate Trace Width Calculation**- The app ensures precision in computing the required trace width based on user-defined inputs such as current, thickness, and temperature rise, adhering to IPC standards.

- **Automated Unit Conversion**- It seamlessly converts between units like mils, mm, inches, and oz/sq ft, minimizing user errors and ensuring consistency across calculations.

- **High-Frequency Electrical Property Analysis**- The tool considers skin depth and frequency-dependent resistance, enabling accurate modeling for high-speed digital and RF PCB designs.

- **Report Generation (PDF Output)**- The app provides an option to export all input data and calculated results in a professional PDF format for documentation and sharing.

- **User-Friendly Interface**- Designed with simplicity in mind, the UI allows engineers, students, and professionals to access complex features without requiring extensive technical expertise.

Key Features of the App

01

PCB Calculator

02

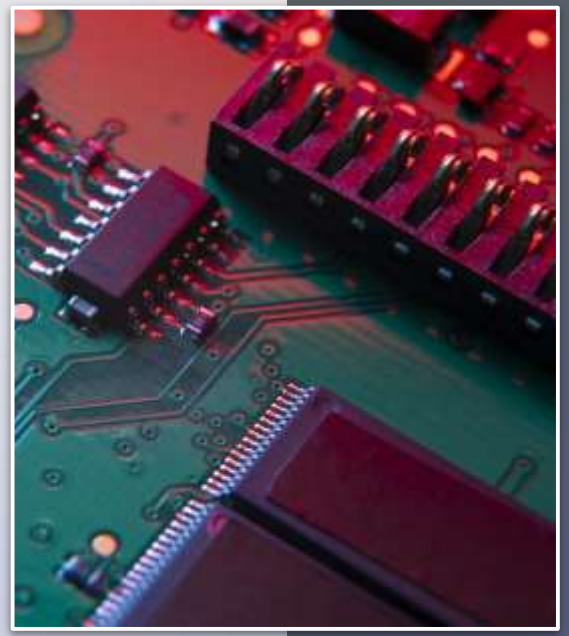
Unit Converter

03

Graph Analyser

04

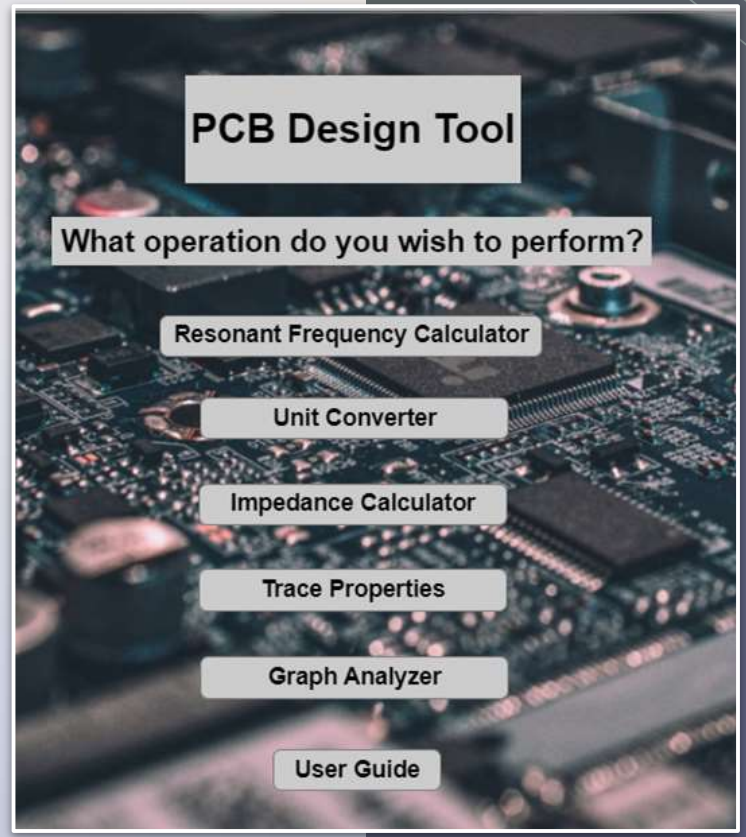
PDF Exporter



HOME PAGE

Features Offered

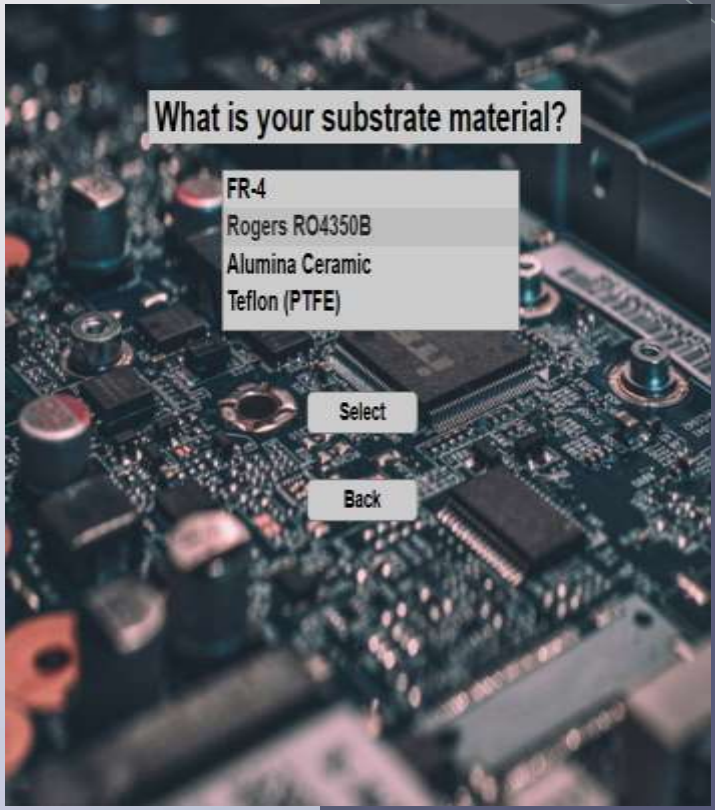
- Resonant Frequency Calculator
- Unit Converter
- Impedance Calculator
- Trace Properties
- Graph Analyser
- User Guide



Material Selector Panel

Features Offered

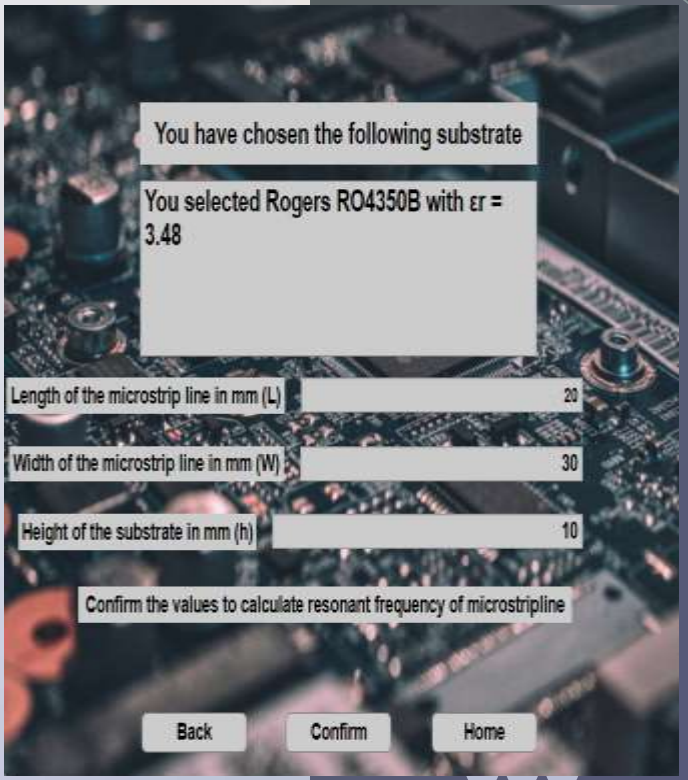
- User can select from a variety of substrate materials
  a. FR-4
  b. Rogers S RO4350B
  c. Alumina Ceramic
  d. Teflon (PTFE)
- Additional options
  a. Select button for confirmation
  b. Back button to return to Home Page



Resonant Frequency Calculator

Features Offered

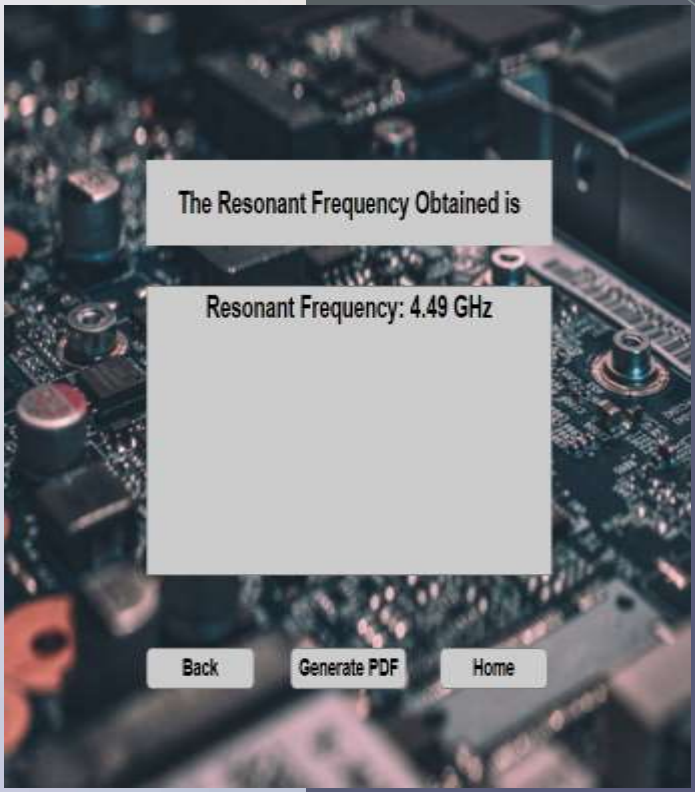
- Material Selection Confirmation Text
- Permittivity of substrate
- Length of the Microstripline in mm
- Width of the Microstripline in mm
- Height of Substrate in mm
- Additional options
  a. Confirm button to execute
  b. Home button to return to Home Page
  c. Back button to return to Material Selector Panel



Resonant Frequency Results

Features Offered

- Result Panel Displaying Resonant Frequency Obtained
- Additional options
  a. Generate PDF button to generate a PDF
  b. Home button to return to Home Page
  c. Back button to return to Resonant Frequency Panel



Unit Converter

Features Offered

- Trace Width value in mils/mm/inches
- Trace Thickness value in (oz/sq ft)/mm/mils
- Trace Length value in mm/mils/inches
- Additional Features
  a. Generate PDF button to generate a PDF
  b. Convert button to execute
  c. Back button to return to Home Page
- Result box displays values in all units

Impedance Calculator

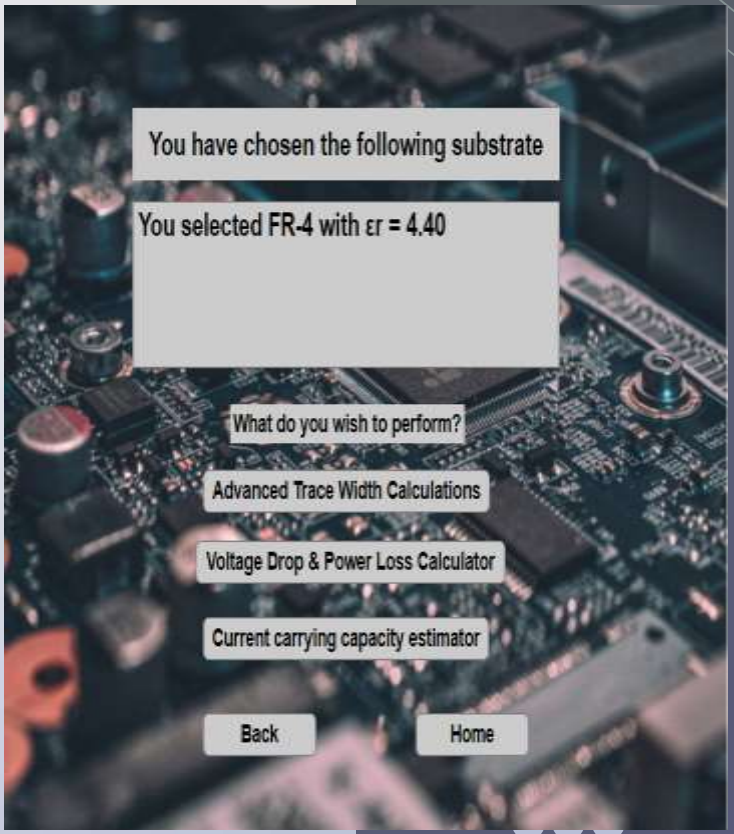
Features Offered

- Material Selection Confirmation Text
- Permittivity of substrate
- Trace Width in mils
- Trace Thickness value in oz/sq ft
- Height of substrate in mm
- Frequency in MHz
- Trace Type (Microstripline/Stripline)
- Additional Features
  a. Generate PDF button to generate a PDF
  b. Calculate button to execute
  c. Back button to return to Material Selector Panel
  d. Home button to return to Home page

Trace Properties

Features Offered

- Material Selection Confirmation Text
- Permittivity of substrate
- Trace Properties Selection option
- Advanced Trace Width Calculations
- Voltage Drop and Power Loss Calculator
- Current Carrying Capacity Estimator
- Additional Features
  a. Back button to return to Material Selector Panel
  b. Home button to return to Home page



Advanced Trace Width Calculator

Features Offered

- Current in A
- Copper Thickness value in oz/sq ft
- Temperature Rise in °C
- Layer Type (Internal/External)
- High Frequency Checkbox
- Frequency value in MHz
- Additional Features
  a. Generate PDF button to generate a PDF
  b. Calculate button to execute
  c. Back button to return to Trace Properties Panel
  d. Home button to return to Home Page
- Result box displays Trace Width Results along with High Frequency Results

Voltage Drop and Power Loss Calculator

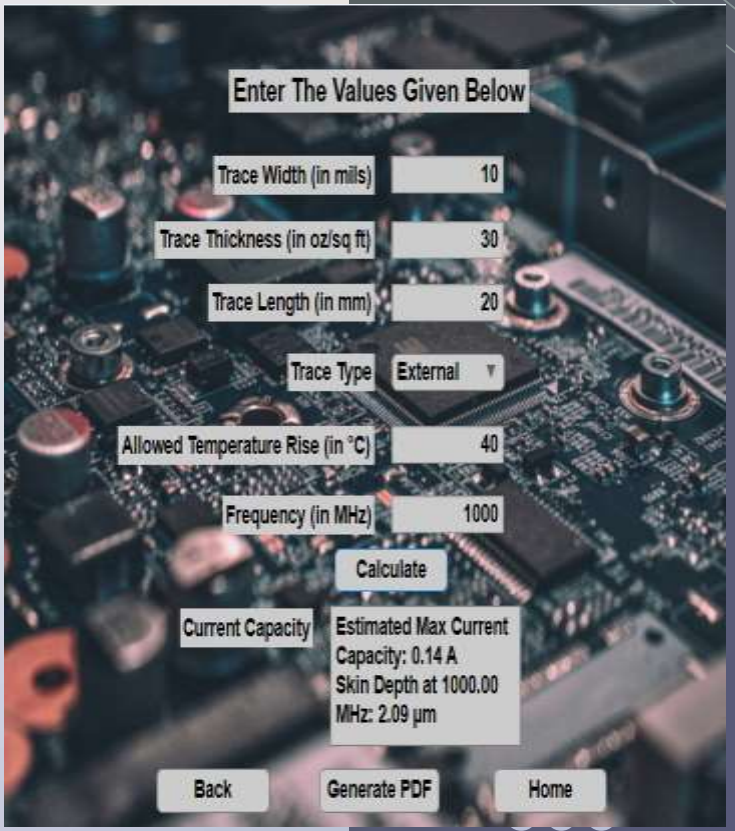
Features Offered

- Current in A
- Copper Thickness value in oz/sq ft
- Trace Length value in mm
- Trace Width value in mils
- Layer Type (Internal/External)
- High Frequency Checkbox
- Frequency value in MHz
- Additional Features
  a. Generate PDF button to generate a PDF
  b. Calculate button to execute
  c. Back button to return to Trace Properties Panel
  d. Home button to return to Home Page
- Result box displays Voltage Drop and Power Loss Calculation Results

Current Carrying Capacity Estimator

Features Offered

- Trace Width value in mils
- Trace Thickness value in oz/sq ft
- Trace Length value in mm
- Trace Type (Internal/External)
- Allowed Temperature Rise in °C
- High Frequency Checkbox
- Frequency value in MHz
- Additional Features
  a. Generate PDF button to generate a PDF
  b. Calculate button to execute
  c. Back button to return to Trace Properties Panel
  d. Home button to return to Home Page
- Result box displays Current Carrying Capacity Estimation Results

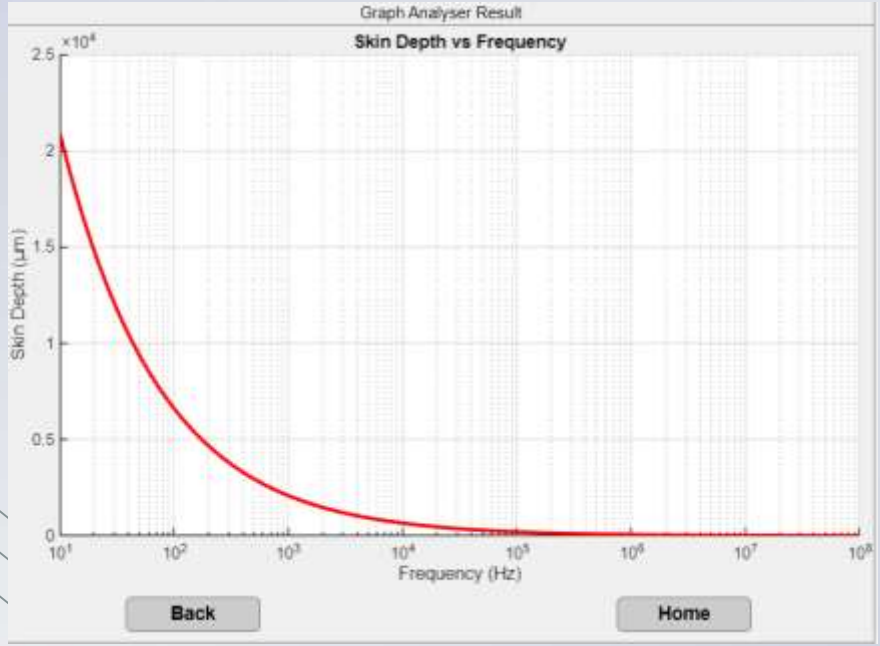


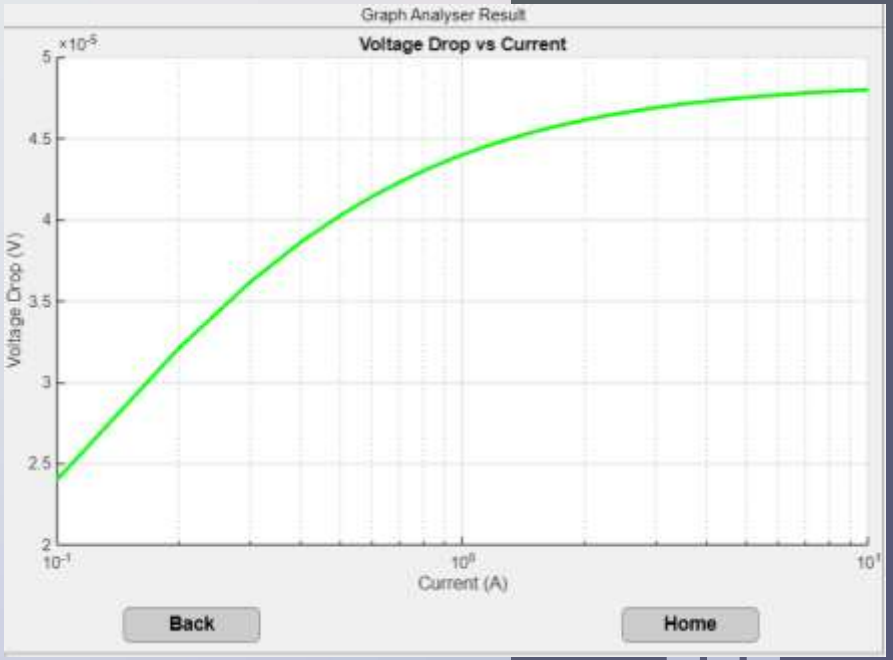
Graph Analyser

Features Offered

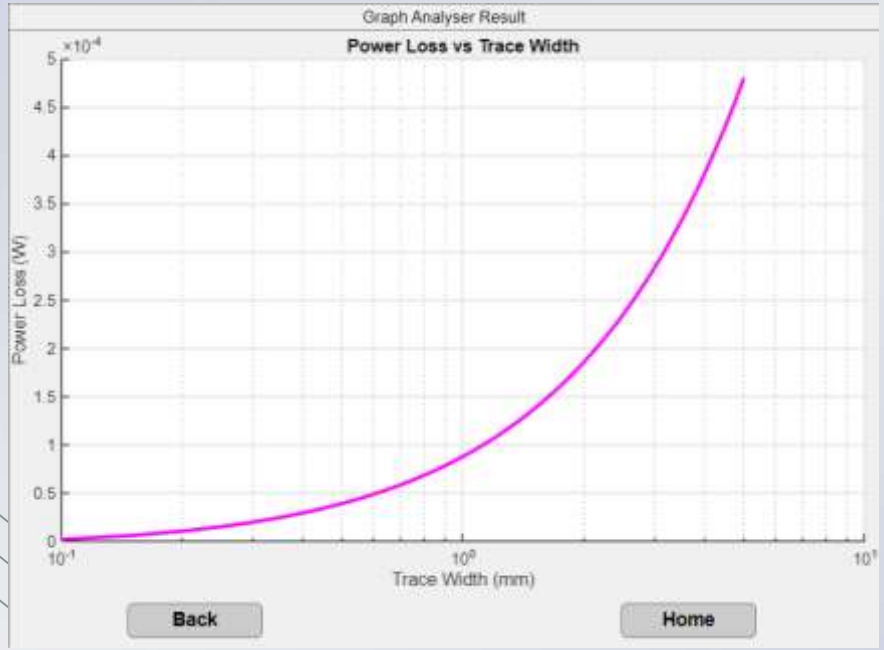
- Drop-down box offering graphs between various parameters
- Result Panel with selected graph opens
- Additional Features
  a. Plot Graph button to obtain graph
  b. Back button to return to Home Page

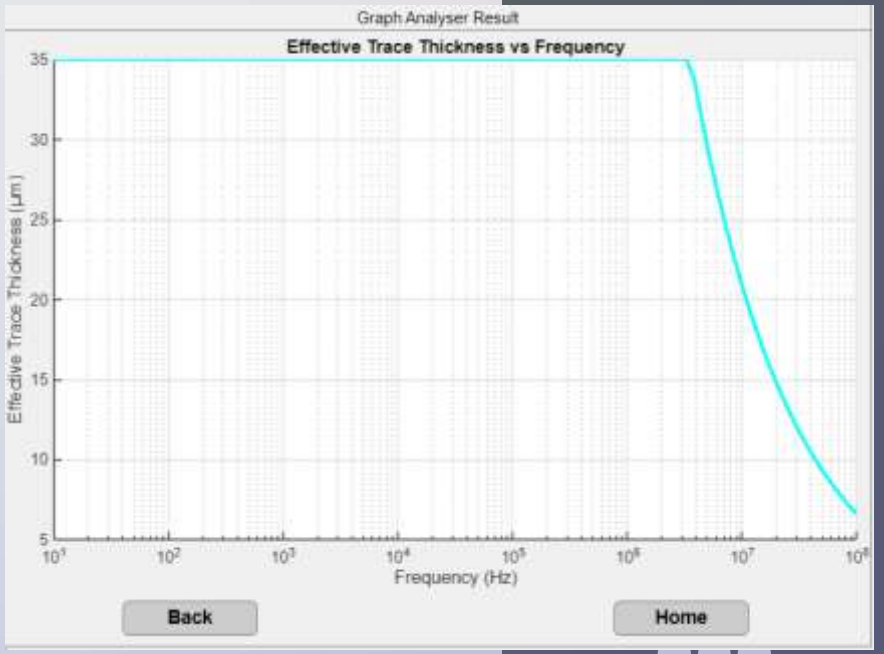
Graph Plots


Graph Analyser Result
Skin Depth vs Frequency
×10^4
2.5
2
1.5
1
0.5
0
Skin Depth (μm)
10^1
10^2
10^3
10^4
10^5
10^6
10^7
10^8
Frequency (Hz)
Back
Home


Graph Analyser Result
Voltage Drop vs Current
×10^-5
5
4.5
4
3.5
3
2.5
2
Voltage Drop (V)
10^-1
10^0
10^1
Current (A)
Back
Home

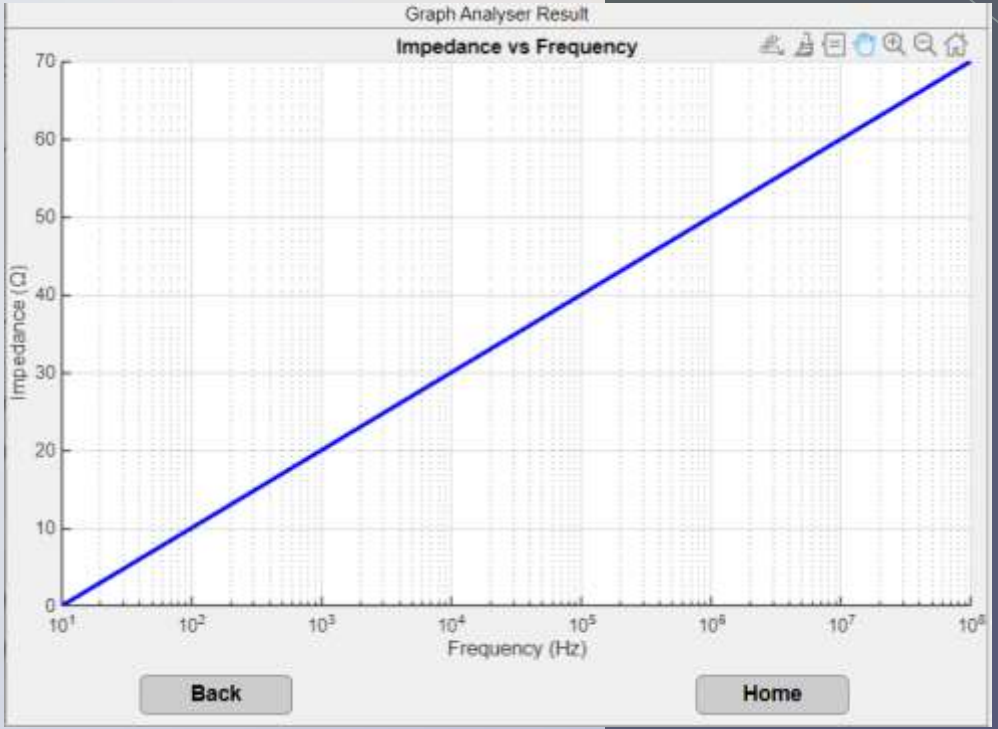
Graph Plots


Graph Analyser Result
Power Loss vs Trace Width
×10⁻⁴
Power Loss (W)
Trace Width (mm)
Back
Home


Graph Analyser Result
Effective Trace Thickness vs Frequency
Effective Trace Thickness (µm)
Frequency (Hz)
Back
Home

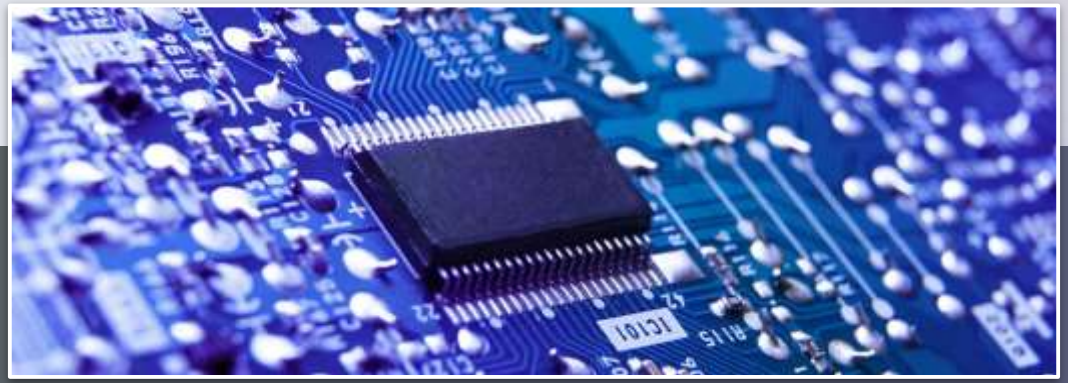
Graph Plots

- **Additional Features**
  a. **Back button to return to Graph Analyser Panel**
  b. **Home button to return to Home Page**

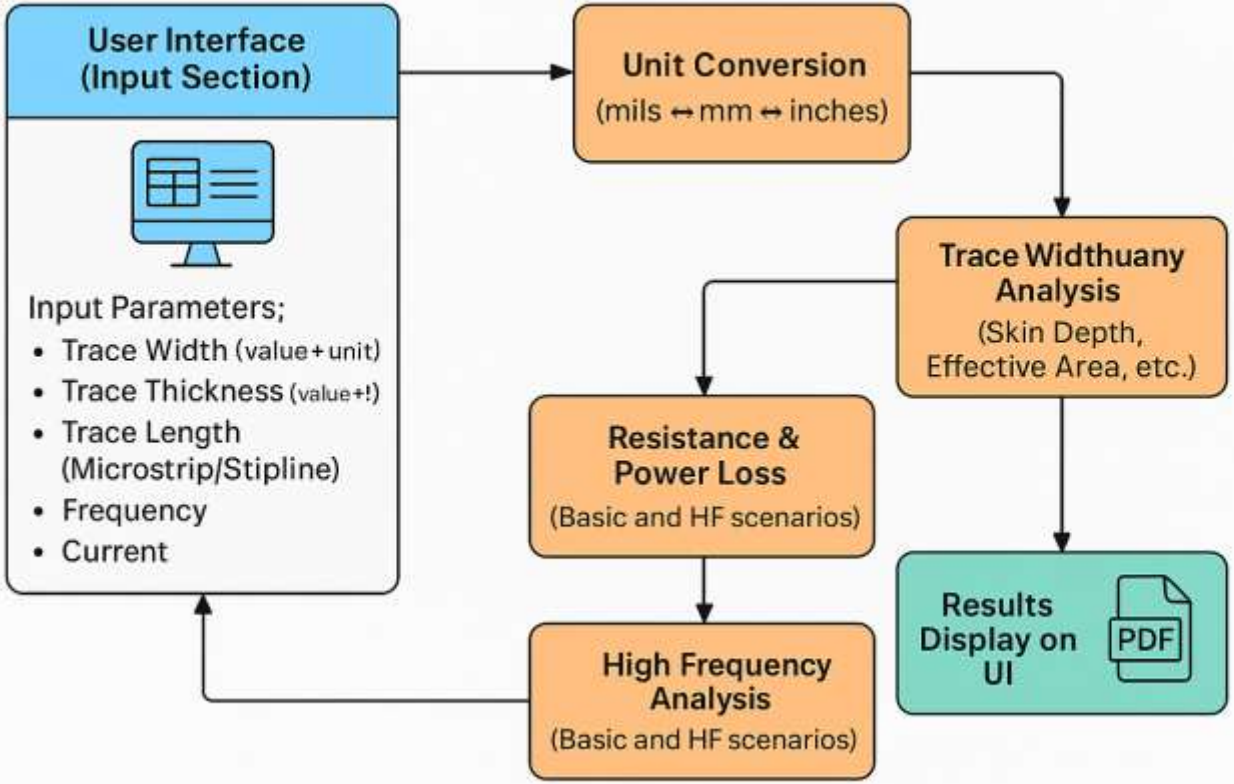


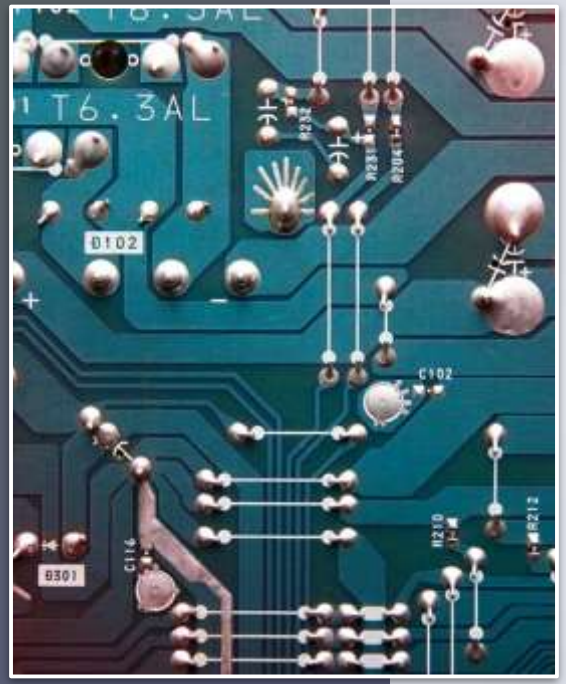
Flow of the App

With the help of Block Diagram



PCB Design Tool App Flow





MATLAB Code

Resonant Frequency Calculations

```
    properties (Access = private)
        PermittivityValue % Description
        UserAction % Description
        Recommendation % Description
    end
methods (Access = private)


    function resonantFrequency = calculateResonantFrequency(app)
    % Get user inputs in mm from the app
    L_mm = app.Length.Value;      % Length in mm
    W_mm = app.Width.Value;       % Width in mm
    h_mm = app.Height.Value;      % Height in mm
    epsilon_r = app.PermittivityValue;     % Relative permittivity (from substrate selection)

    % Convert mm to meters
    L = L_mm / 1000;
    W = W_mm / 1000;
    h = h_mm / 1000;

    % Speed of light (m/s)
    c = 3e8;

    % Calculate Effective Dielectric Constant (ε_eff)
    epsilon_eff = (epsilon_r + 1)/2 + ((epsilon_r - 1)/2) * (1 / sqrt(1 + 12 * (h / W)));

    % Calculate Resonant Frequency (Hz)
    resonantFrequency = c / (2 * L * sqrt(epsilon_eff));

    % Display the result in the app in GHz
    message = sprintf('Resonant Frequency: %.2f GHz', resonantFrequency / 1e9);
    app.Result.Value = message;
end
```

Material Selection Panel

```
% Helper function to get substrate selection from ListBox
function selectedSubstrate = getSelectedSubstrate(app)
    selectedSubstrate = app.ListBox.Value;
end

% Helper function to update TextArea based on selection
function updateTextArea(app, selectedSubstrate)
    switch selectedSubstrate
        case 'FR-4'
            permittivity = 4.4;
        case 'Rogers RO4350B'
            permittivity = 3.48;
        case 'Alumina Ceramic'
            permittivity = 9.8;
        case 'Teflon (PTFE)'
            permittivity = 2.1;
        otherwise
            permittivity = NaN;
    end
    app.PermittivityValue = permittivity;
    message = sprintf('You selected %s with εr = %.2f', selectedSubstrate, permittivity);
    if strcmp(app.UserAction, 'ResonantFrequency')
           app.SubstrateConf.Value = message;
        elseif strcmp(app.UserAction, 'TraceProperties')
           app.SubstrateConf_TP.Value = message;
       elseif strcmp(app.UserAction, 'ImpedanceCalculator')
           app.SubConf.Value = message;
       else
           uialert(app.UIFigure, 'Unknown action selected!', 'Error');
    end

    app.SubstrateConf.Value = message;
end
```

Material Selection Panel

```
% Button pushed function: SelectButton
function SelectButtonPushed(app, event)

    selectedSubstrate = getSelectedSubstrate(app);

    updateTextArea(app, selectedSubstrate);

    app.MaterialSelectorPanel.Visible = 'off';

    if strcmp(app.UserAction, 'ResonantFrequency')
        app.ResonantFrequencyPanel.Visible = 'on';
    elseif strcmp(app.UserAction, 'TraceProperties')
        app.TraceProperties.Visible = 'on';
    elseif strcmp(app.UserAction, 'ImpedanceCalculator')
        app.ImpedanceCalculator.Visible = 'on';
    else
        uialert(app.UIFigure, 'Unknown action selected!', 'Error');
    end
end
```

Trace Width Calculation Panel

```
    % For high-frequency PCB, consider skin effect (simple correction)
    % Assuming increased width by 10% as a factor (for illustration)
    hf_correction_factor = 1.1;
    app.HFResultsTextArea.Value = {
        sprintf('High-Frequency Mode Enabled:\n')
        sprintf('- Skin Depth: %.2f µm at %.2f MHz\n', delta_microns, frequency)
        sprintf('-%s\n', recommendation)
        sprintf('-Effective Area: %.4f mm^2\n', A_effective_mm2);
        sprintf('- Consider wider traces or thicker copper to mitigate skin effect.\n');
    };
end

% Apply correction
final_trace_width_mils = trace_width_mils * hf_correction_factor;


% --- Display results ---
result_message = sprintf(['Recommended Trace Width (basic): %.2f mils\n'...
                          'Recommended Trace Width (High Frequency): %.2f mils\n'], ...
                          trace_width_mils, final_trace_width_mils);

app.TraceWidthResultsTextArea.Value = result_message;
```

Trace Width Calculation Panel

```
        % --- Get user inputs ---
current = app.CurrentEditField.Value; % in Amps
copper_thickness_oz = app.CopperThicknessEditField.Value; % in oz
temp_rise = app.TempRiseEditField.Value; % in °C
layer_type = app.LayerTypeDropDown.Value; % 'Internal' or 'External'
high_freq_enabled = app.HighFreqCheckBox.Value; % true/false
frequency = app.FrequencyEditField.Value; % MHz (user input)


% --- IPC-2221 constants ---
if strcmp(layer_type, 'External')
    k = 0.048;
    b = 0.44;
    c = 0.725;
elseif strcmp(layer_type, 'Internal')
    k = 0.024;
    b = 0.44;
    c = 0.725;
else
    uialert(app.UIFigure, 'Invalid layer type selected!', 'Error');
    return;
end

% --- Calculate trace area in sq mils ---
% Formula: Width (mil) = (Current / (k * (TempRise^b))) ^ (1/c)
trace_area = (current / (k * (temp_rise^b)))^(1/c);

% --- Convert to mm ---
trace_width_mils = trace_area/((copper_thickness_oz)*1.378);
```

```
% --- High Frequency Considerations ---
hf_correction_factor = 1.0; % default no correction

if high_freq_enabled
    % Constants for Copper
    mu = 4 * pi * 1e-7;          % Permeability of free space (H/m)
    sigma_cu = 5.8e7;              % Conductivity of copper (S/m)
    % Skin Depth Calculation (in meters)
    delta = sqrt(1 / (pi * frequency * mu * sigma_cu));
    % Convert to microns for easier reading
    delta_microns = delta * 1e3;
    % Display the result
    if delta_microns < 5
        recommendation = 'Consider increasing trace width or using silver/gold plating for high-frequency perform
        elseif delta_microns < 20
        recommendation = 'Ensure your trace width accommodates skin effect losses.';
        else
        recommendation = 'Standard copper trace is sufficient at this frequency.';
    end

    % Display recommendation


    % Convert trace width to meters
    trace_width_m = trace_width_mils * 2.54e-5;
    % Effective area (in square meters)
    A_effective = trace_width_m * delta;
    % Convert to square mm for display
    A_effective_mm2 = A_effective * 1e6;
    % Display the result
```

Unit Converter Panel

```
function ConvertButtonPushed(app, event)
    % Get user inputs
    W_value = app.TraceWidthEditField.Value;
    W_unit = app.WidthDropDown.Value;

    T_value = app.TraceThicknessEditField.Value;
    T_unit = app.ThicknessDropDown.Value;

    L_value = app.TraceLengthEditField.Value;
    L_unit = app.LengthDropDown.Value;

    % Convert Trace Width to mm
    switch W_unit
        case 'mils'
            W_mm = W_value * 0.0254; % 1 mil = 0.0254 mm
            W_inches = W_value * 0.001;
            W_mils = W_value;
        case 'inches'
            W_mm = W_value * 25.4; % 1 inch = 25.4 mm
            W_mils = W_value * 1000;
            W_inches = W_value;
        case 'mm'
            W_mm = W_value; % Already in mm
            W_inches = W_value * 0.0393701;
            W_mils = W_value * 39.3701;
        otherwise
            W_mm = NaN;
    end
```

```
% Display results
app.ResultTextArea.Value = sprintf( ...
    "Converted Trace Width:\n %.3f mm\n %.3f inches\n %.3f mils\nConverted Trace Thickness:\n
    W_mm, W_inches, W_mils, T_mm, T_oz, T_mils, L_mm, L_mils, L_inches);
```

```
% Convert Trace Thickness to mm
switch T_unit
    case 'oz/sq ft'
        T_mm = T_value * 0.0348; % 1 oz/ft² ≈ 0.0348 mm
        T_mils = T_value * 1.37;
        T_oz = T_value;
    case 'mils'
        T_mm = T_value * 0.0254; % 1 mil = 0.0254 mm
        T_mils = T_value;
        T_oz = T_value * 0.729927;
    case 'mm'
        T_mm = T_value; % Already in mm
        T_mils = T_value * 39.3701;
        T_oz = T_value * 28.74;
    otherwise
        T_mm = NaN;
end

% Convert Trace Length to mm
switch L_unit
    case 'mils'
        L_mm = L_value * 0.0254; % 1 cm = 10 mm
        L_mils = L_value;
        L_inches = L_value * 0.001;
    case 'inches'
        L_mm = L_value * 25.4; % 1 inch = 25.4 mm
        L_mils = L_value * 1000;
        L_inches = L_value;
    case 'mm'
        L_mm = L_value; % Already in mm
        L_mils = L_value * 39.3701;
        L_inches = L_value * 0.0393701;
    otherwise
        L_mm = NaN;
```

Graph Analyser Panel

```
function PlotButtonPushed(app, event)
    app.GraphAnalyser.Visible = 'off';
    app.GraphAnalyserResult.Visible = 'on';



    % Get the selected graph type
    selectedGraph = app.GraphTypeDropDown.Value;

    % Clear previous plot and enable multiple graphs if needed
    cla(app.UIAxes);
    hold(app.UIAxes, 'on');

    % Define frequency range (log scale for better visualization)
    freq = logspace(1, 8, 100); % 10 Hz to 100 MHz

    % Define a sample current range for voltage drop and power loss calculations
    current = linspace(0.1, 10, 100); % 0.1A to 10A

    % Example parameters
    trace_width = linspace(0.1, 5, 100); % Width range in mm
    trace_thickness = 35e-6; % 35µm copper thickness (standard 1 oz)
    resistivity_copper = 1.68e-8; % Ohm-m
    trace_length = 50e-3; % 50mm trace length

    % Constants for skin depth
    mu = 4 * pi * 1e-7; % Permeability of free space
    sigma = 5.8e7; % Conductivity of copper (S/m)
```

Graph Analyser Panel

```
% Perform calculations based on selected graph
switch selectedGraph
    case 'Impedance vs Frequency'
        Z0 = 50 + 10*log10(freq / 1e6); % Example formula for impedance
        plot(app.UIAxes, freq, Z0, 'b-', 'LineWidth', 2, 'MarkerSize', 5);
        xlabel(app.UIAxes, 'Frequency (Hz)');
        ylabel(app.UIAxes, 'Impedance (Ω)');
        title(app.UIAxes, 'Impedance vs Frequency');
        grid(app.UIAxes, 'on');
        set(app.UIAxes, 'XScale', 'log'); % Log scale for better frequency visualization

    case 'Skin Depth vs Frequency'
        delta = 1 ./ sqrt(pi * freq * mu * sigma); % Skin depth formula
        plot(app.UIAxes, freq, delta * 1e6, 'r-', 'LineWidth', 2, 'MarkerSize', 5);
        xlabel(app.UIAxes, 'Frequency (Hz)');
        ylabel(app.UIAxes, 'Skin Depth (µm)');
        title(app.UIAxes, 'Skin Depth vs Frequency');
        grid(app.UIAxes, 'on');
        set(app.UIAxes, 'XScale', 'log'); % Log scale

    case 'Voltage Drop vs Current'
        resistance = resistivity_copper * trace_length ./ (trace_width * trace_thickness); % R = ρL
        voltageDrop = current .* resistance; % V = IR
        plot(app.UIAxes, current, voltageDrop, 'g-', 'LineWidth', 2, 'MarkerSize', 5);
        xlabel(app.UIAxes, 'Current (A)');
        ylabel(app.UIAxes, 'Voltage Drop (V)');
        title(app.UIAxes, 'Voltage Drop vs Current');
        grid(app.UIAxes, 'on');
```

```
    case 'Power Loss vs Trace Width'
        resistance = resistivity_copper * trace_length ./ (trace_width * trace_thickness);
        powerLoss = (current.^2) .* resistance; % P = I²R
        plot(app.UIAxes, trace_width, powerLoss, 'm-', 'LineWidth', 2, 'MarkerSize', 5);
        xlabel(app.UIAxes, 'Trace Width (mm)');
        ylabel(app.UIAxes, 'Power Loss (W)');
        title(app.UIAxes, 'Power Loss vs Trace Width');
        grid(app.UIAxes, 'on');

    case 'Effective Trace Thickness vs Frequency'
        delta = 1 ./ sqrt(pi * freq * mu * sigma); % Skin depth
        effective_thickness = min(trace_thickness, delta); % Copper thickness limited by skin depth
        plot(app.UIAxes, freq, effective_thickness * 1e6, 'c-', 'LineWidth', 2, 'MarkerSize', 5);
        xlabel(app.UIAxes, 'Frequency (Hz)');
        ylabel(app.UIAxes, 'Effective Trace Thickness (µm)');
        title(app.UIAxes, 'Effective Trace Thickness vs Frequency');
        grid(app.UIAxes, 'on');
        set(app.UIAxes, 'XScale', 'log'); % Log scale

    otherwise
        cla(app.UIAxes); % Clear axes if no valid selection
end


% Enable Zoom & Pan
zoom(app.UIAxes, 'on');
pan(app.UIAxes, 'on');

% Show Grid
grid(app.UIAxes, 'on');

% Hold off for new plots
hold(app.UIAxes, 'off');
```

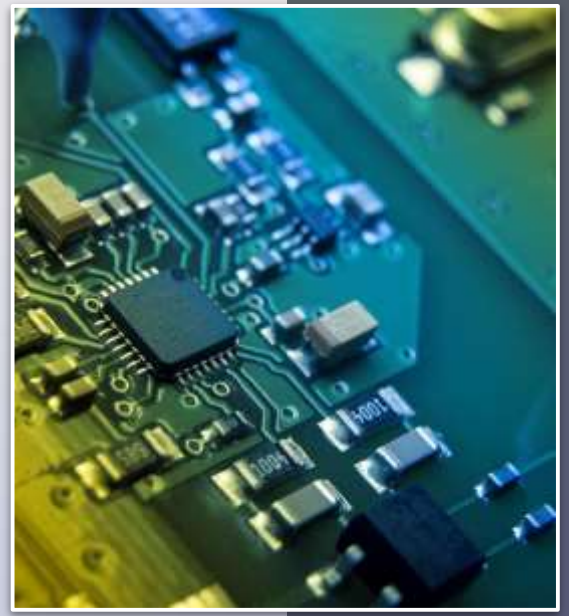
Generate PDF Button

```
function GenerateButtonPushed(app, event)
    % Get input values from UI components
    L_mm = app.Length.Value;
    W_mm = app.Width.Value;
    h_mm = app.Height.Value;
    permittivity = app.PermittivityValue;


    % Convert mm to meters
    L = L_mm / 1000;
    W = W_mm / 1000;
    h = h_mm / 1000;

    % Speed of light (m/s)
    c = 3e8;


    % Calculate Effective Dielectric Constant (ε_eff)
    epsilon_eff = (permittivity + 1)/2 + ((permittivity - 1)/2) * (1 / sqrt(1 + 12 * (h / W)));
    resonantFrequency = c / (2 * L * sqrt(epsilon_eff));




    % Create a unique filename with timestamp
    timestamp = datestr(now, 'yyyy-mm-dd_HH-MM-SS');
    pdfFileName = ['Resonant_Frequency_Report_' timestamp '.pdf'];

    % Create PDF document
    import mlreportgen.dom.*;
    doc = Document(pdfFileName, 'pdf');
```

```
% Title
titlePara = Paragraph('Resonant Frequency Report');
titlePara.Bold = true;
titlePara.FontSize = '14pt';
append(doc, titlePara);
append(doc, HorizontalRule());

% Input Parameters Table
append(doc, Paragraph('Input Parameters:'));
inputTable = Table({...
    'Parameter', 'Value', 'Unit'; ...
    'Length', L_mm, 'mm'; ...
    'Width', W_mm, 'mm'; ...
    'Height of Substrate', h_mm, 'mm'; ...
    'Permittivity', permittivity, ''});

% Apply Border to Table
inputTable.Border = 'solid';
inputTable.Style = {Width('100%')}; % Ensure it fits within page width
append(doc, inputTable);

% Output Section
append(doc, Paragraph('Calculated Resonant Frequency:'));
freqText = Paragraph(sprintf('%.2f GHz', resonantFrequency / 1e9));
freqText.Bold = true;
freqText.FontSize = '12pt';
append(doc, freqText);

% Close and save the document
close(doc);

% Notify user
msgbox(['PDF report saved as: ' pdfFileName], 'Success');
```

Export Options

- The PCB Design Tool App provides a “Generate PDF” button at the end of each result panel.
- Upon clicking this button, a PDF is generated by the App and the user can save input and output values for future use.
- The PDF layout is designed in a tabular format allowing neat and visually appealing format.



Resonant Frequency Report

Resonant Frequency Report

Input Parameters:

Parameter	Value	Unit
Length	20	mm
Width	30	mm
Height of Substrate	10	mm
Permittivity	4.4000000000000004	

Calculated Resonant Frequency:

4.03 GHz

Unit Conversion Report

Unit Conversion Report

Input Parameters:

Parameter	Value	Unit
Trace Width	10.00	mils
Trace Thickness	20.00	oz/sq ft
Trace Length	50.00	mm

Calculated Units:

Parameter	Value	Unit
Trace Width	0.25	mm
Trace Width	0.01	inches
Trace Width	10.00	mils
Trace Thickness	0.70	mm
Trace Thickness	27.40	mils
Trace Thickness	20.00	oz
Trace Length	50.00	mm
Trace Length	1968.51	mils
Trace Length	1.97	inches

Advanced Trace Width Report

Trace Width Calculation Report

Input Parameters:

Parameter	Value	Unit
Current	2.00	A
Copper Thickness	1.00	oz/sq ft
Temperature Rise	40.00	°C
Layer Type	External	
High Frequency PCB	TRUE	
frequency	1000.00	MHz

Calculated Units:

High Frequency Results:

Parameter	Value	Unit
High-Frequency Mode:	TRUE	
Skin Depth	2.09	µm
Recommendation	Consider increasing trace width or using silver/gold p lating for high-frequency performance.	
Effective Area	0.70	mm^ 2
Additional Remarks	Consider wider traces or thicker copper to mitigate sk in effect	

Trace Width Results:

Parameter	Value	Unit
Recommended Trace Width (basic)	13.26	mils
Recommended Trace Width (High Frequency)	14.59	mils

Voltage Drop and Power Loss Report

Voltage Drop Calculation Report

Input Parameters:

Parameter	Value	Unit
Current	2.00	A
Copper Thickness	10.00	oz/sq ft
Trace Length	10.00	mm
Trace Width	30.00	mils
Layer Type	Internal	
High Frequency PCB	TRUE	
frequency	1000.00	MHz

Calculated Units:

High Frequency Results:

Parameter	Value	Unit
High-Frequency Mode:	TRUE	
Cross-sectional Area (High Frequency):	1.499e-03	mm^2
Resistance (High Frequency):	112.09	mΩ
Voltage Drop (High Frequency):	224.18	mV
Power Loss (High Frequency):	0.45	W

Voltage Drop and Power Loss Results:

Parameter	Value	Unit
Trace Type:	Internal	
Cross-sectional Area (Basic):	2.652e-01	mm^2
Resistance (Basic):	0.79	mΩ
Voltage Drop (Basic):	1.58	mV
Power Loss (Basic):	0.00	W

Current Carrying Capacity Report

Current Carrying Capacity Report

Input Parameters:

Parameter	Value	Unit
Trace Width	10.00	mils
Trace Thickness	30.00	oz/sq ft
Trace Type	External	
Allowed Temperature Rise	40.00	°C
frequency	1000.00	MHz

Calculated Units:

Parameter	Value	Unit
Trace Type:	External	
Estimated Max Current Capacity:	0.14	A
Skin Depth:	2.09	µm

Impedance Calculation Report

Impedance Calculator Report

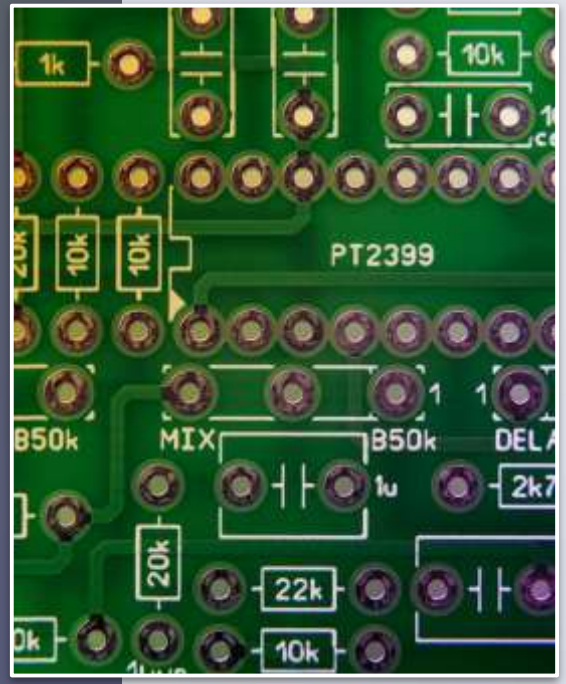
Input Parameters:

Parameter	Value	Unit
Trace Width	10.00	mils
Trace Thickness	20.00	oz/sq ft
Height of Substrate	30.00	mm
Frequency	40.00	MHz
Trace Type	Microstrip	
Permittivity	4.40	

Calculated Units:

Parameter	Value	Unit
Estimated Impedance	248.10	Ω
Effective Permittivity	2.75	
Skin Depth	0.01	mm
Converted Width	0.25	mm
Converted Thickness	0.70	mm

Modules Used



MATLAB App Designer

This App is developed using MATLAB R2025a version

MATLAB Report Generator

This App is compatible with version R2021a to R2025a

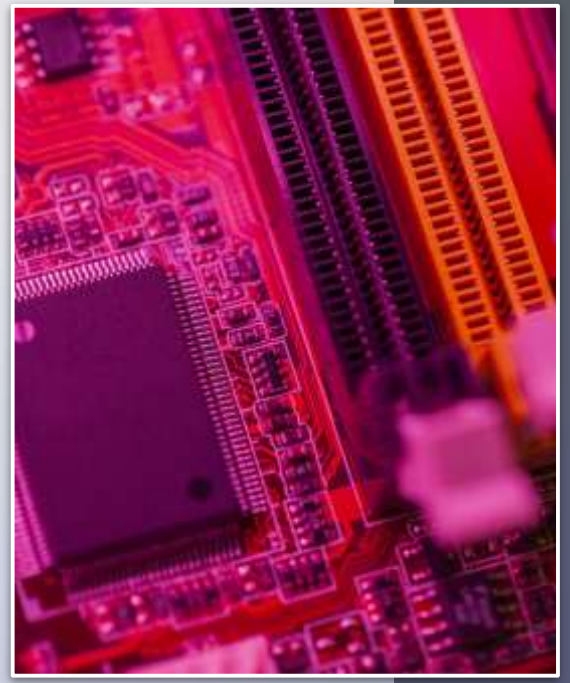
MATLAB plotting tools

For Graph Analysis

Applications and Future Improvements

Applications

- Academic use (projects, simulations)
- Industry-grade prototyping
- Teaching electronics concepts
- Tool for PCB/VLSI engineers

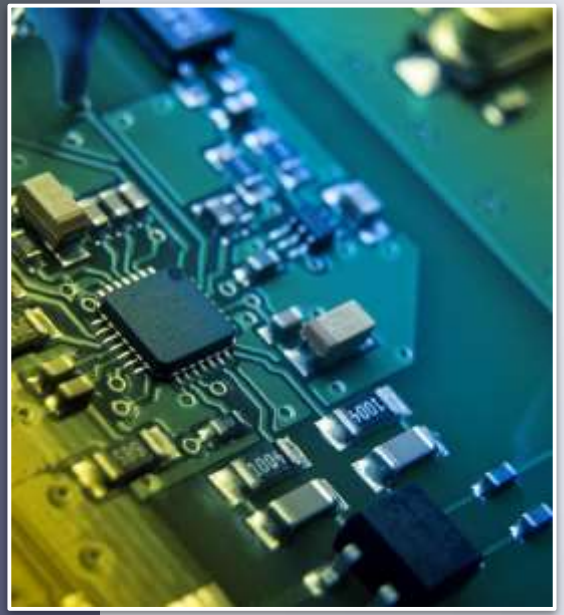


Future Improvements

- Impedance calculator
- Signal integrity checker
- Heat dissipation estimator
- Export to Gerber file format

  Adding more trace types (coplanar, differential)

References and Support



App Code

I have uploaded the entire MATLAB App code on Google Drive

Mathworks

This App can also be found on Mathworks File Exchange

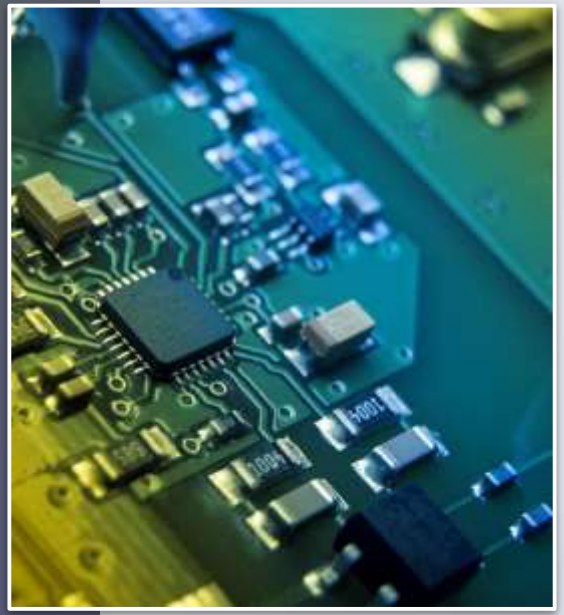
User Guide

The Home Page also contains a user guide about the app details

Report PDFs

I have also attached a Google Drive link of all the report PDFs generated

References and Support



App Code

To open the code text file,
click here
Or, click here

Mathworks

https://in.mathworks.com/matlabcentral/fileexchange/180607-pcb-design-tool-app?s_tid=srchtitle

User Guide

To open the User Guide,
click here
Or, click here

Report PDFs

To open the Reports Folder,
click here
Or, click here

Important:

1. **Please Download the PTSL App Folder before opening the link**
2. **Kindly Make sure to read the Instruction Manual PDF before proceeding**
3. **It could be possible that the MathWorks link does not open upon clicking. In such a situation, the user is asked to copy and paste the link on chrome or any web browser**