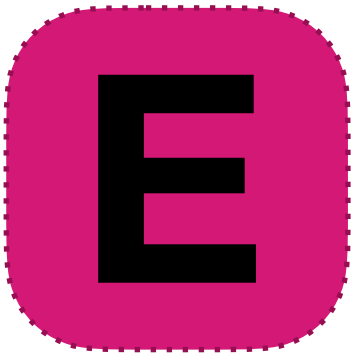

lectronics

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INTRODUCTION

MATLAB

MATLAB an abbreviation of "MATrix LABoratory" is a proprietary multi-paradigm programming language and numeric computing environment developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages.

MATLAB was invented by mathematician and computer programmer Cleve Moler. The idea for MATLAB was based on his 1960s PhD thesis

The first early version of MATLAB was completed in the late 1970s. The software was disclosed to the public for the first time in February 1979 at the Naval Postgraduate School in California. Early versions of MATLAB were simple matrix calculators with 71 pre-built functions. At the time, MATLAB was distributed for free to universities. Moler would leave copies at universities he visited and the software developed a strong following in the math departments of university campuses.

The MATLAB application is built around the MATLAB programming language. Common usage of the MATLAB application involves using the "Command Window" as an interactive mathematical shell or executing text files containing MATLAB code. It contains a very powerful help tool. Every function used in editing Matlab source codes can be found in the Matlab help.

MATLAB supports structure data types. Since all variables in MATLAB are arrays, a more adequate name is "structure array", where each element of the array has the same field names. In addition, MATLAB supports dynamic field names

ELECTRONICS

The field of electronics is a branch of physics and electrical engineering that deals with the emission, behaviour and effects of electrons using electronic devices. Electronics uses active devices to control electron flow by amplification and rectification, which distinguishes it from classical electrical engineering, which only uses passive effects such as resistance, capacitance and inductance to control electric current flow.
Electronics has hugely influenced the development of modern society. The central driving force behind the entire electronics industry is the semiconductor industry sector, which has annual sales of over $481 billion as of 2018. The largest industry sector is e-commerce, which generated over $29 trillion in 2017.

An electronic component is any component in an electronic system either active or passive. Components are connected together, usually by being soldered to a printed circuit board (PCB), to create an electronic circuit with a particular function. Components may be packaged singly, or in more complex groups as integrated circuits. Passive electronic components are capacitors, inductors, resistors, whilst active components are such as semiconductor devices; transistors and thyristors, which control current flow at electron level

Electronic circuit functions can be divided into two function groups: analog and digital. A particular device may consist of circuitry that has one or the other or a mix of the two types. Analog circuits are becoming less common, as many of their functions are being digitised.

THEORETICAL ASPECTS

THEME

The theme of the project is Electronics. It contains circuits, trigonometric function and also some 3D plots. The main window contains 3 push buttons that take you to the next figure, where there are some radio buttons, each one of them containing a plot. The plots are: RC circuit, RL circuit, DR circuit, Simple 3D plot, Meshgrid, Cylinder, Difference(sin,cos,tan) , Cos/Sine overlay and Animation. They are all written in different scripts with different positions and background colors. Morevore, some of them have edit buttons that allow you to change some variables, for example the frequency and the amplitude.

FORMULAS

Here are the formulas used in the project.

Voltage and current RL

```
v=A*cos(2*pi*f*t);              %voltage for RL
a_rad = (60*pi/180);            %phase
i=10*cos(2*pi*f*t + a_rad);     %current for RL
```

Output voltage DR

```
vin=A*sin(2*pi*f*t);            %input voltage
vout = zeros(size(vin));
for i = 1:length(t).            %output voltage
    if(vin(i) >=0)
        vout(i)=vin(i);
```

RC voltage

```
v= 6*exp(-2*t);                %voltage for RC
```

Difference sin/cos/tan

```
x1=A*sin(2*pi*f*t);

x2=B*cos(10*2*pi*f*t);

x3=x1-x2;                      %diff. sin and cos

x4=C*tan(2*pi*f*t);

x5=D*tan(5*2*pi*f*t);

x6=x4-x5;                      %diff. tan and tan
```

Sine and Cosine

```
y1=cos(x);                     %cos formula

y2=cos(x-0.60);

y3=cos(x-0.10);

y4=cos(x+0.10);
```

3D plot

```
F= -X.^2.*Z.^2-(2/80).*Y.^3.*Z+(X.^2+60.*Y.^4+Z.^2-0.3).^3;  %formula: 4 leaf
clover
```

Animation

```
x = 2*sin(t);

y = x.^2;

z = y.*cos(t);
```

EXPERIMENTAL ASPECTS

INTERFACE

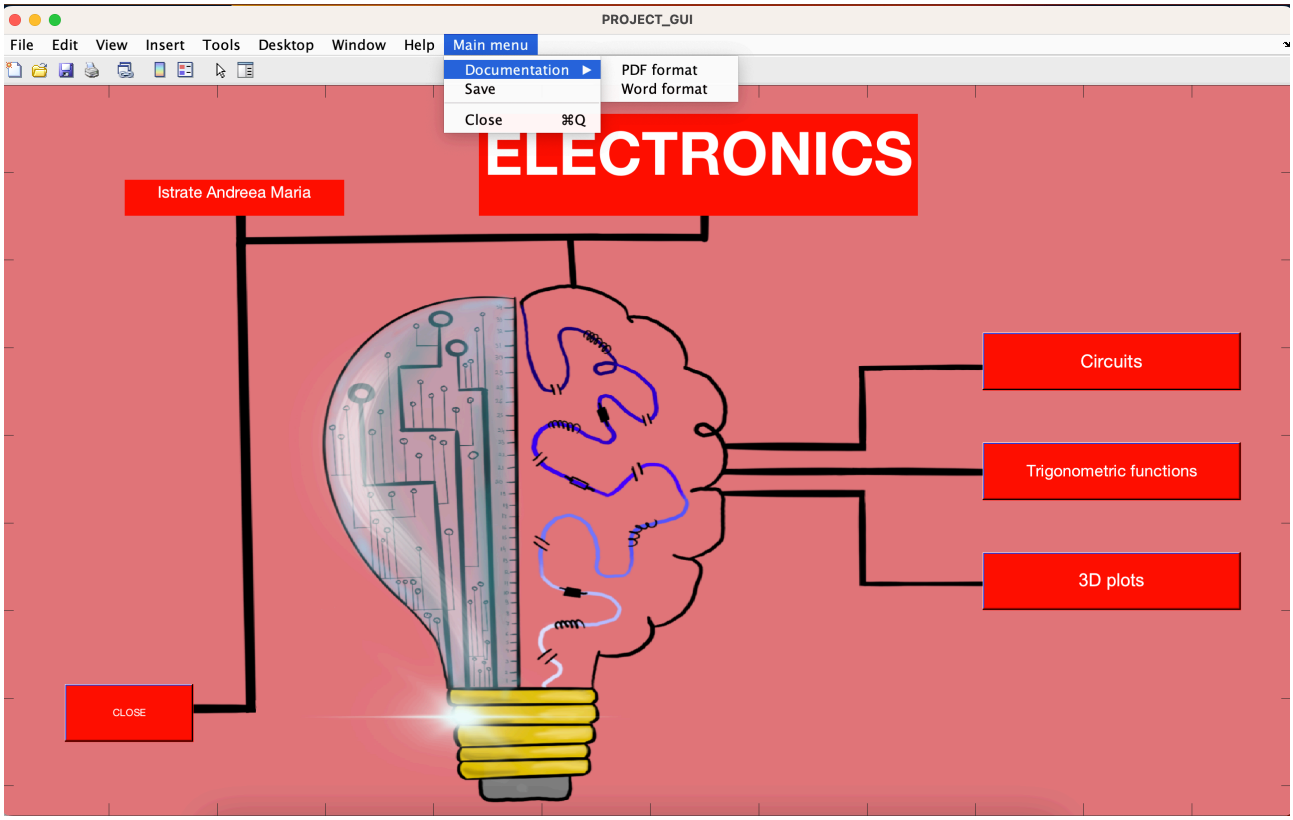


Figure 1

Figure 1 represents the main interface. It contain the title, the student's name, a pushbutton that closes the window and 3 more push buttons, each one of them opening a new window (figure 2). Also, the main interface contains a Main menu, from where you can open the documentation, either in pdf or in word, depending on which one you want.

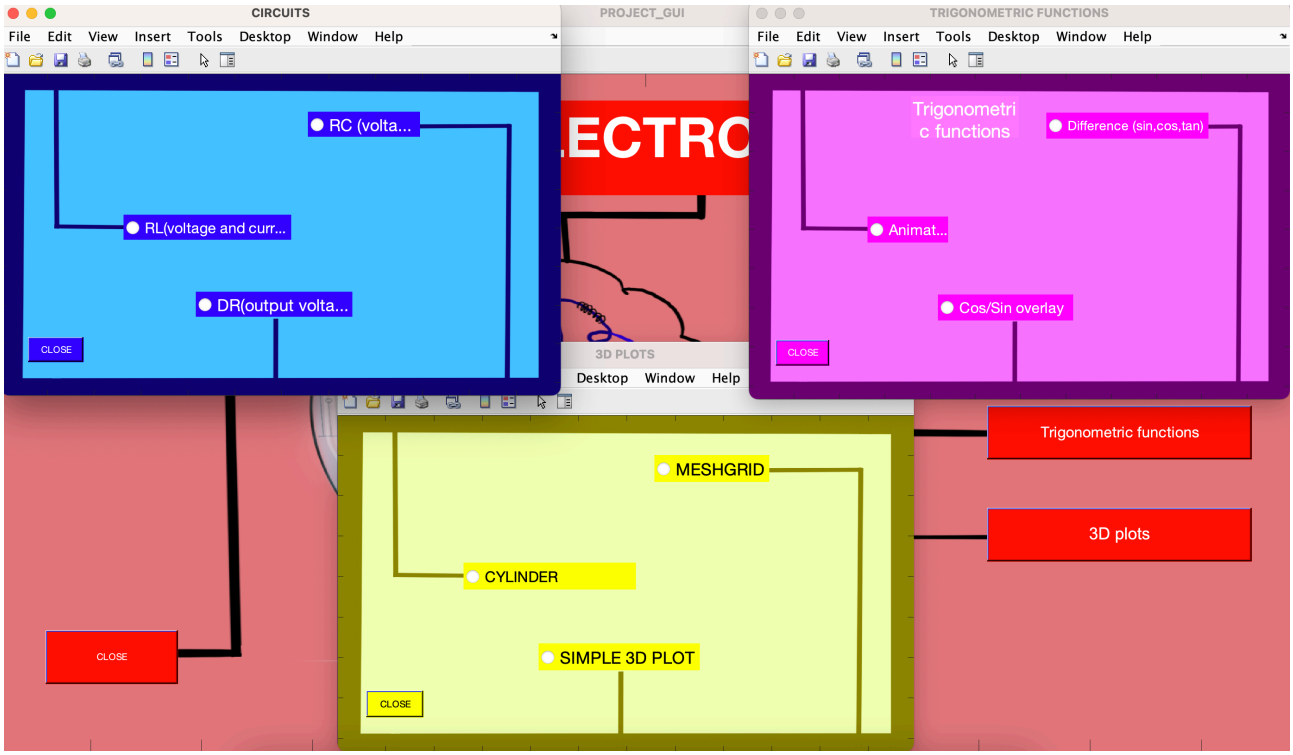


Figure 2

Figure 2 contains the next interfaces, each of the figure containing 3 radio buttons. When pressed, they open different plots. All of the main interfaces have an image as the background. The code for the background is:

```
ha = axes('units','normalized',...
    'Position',[0 0 1 1]);
uistack(ha,'bottom');
I=imread('GUI.png');            %the background image
hi = imagesc(I);
```

CIRCUITS

Figure 3 contains the plots for the circuits, respectively RC, DR, RL. They contain a menu called " 'Name' image ", that opens they're drawn circuit. The DR and RL, also have two edit buttons each, for amplitude and frequency. They represent the output voltage of the DR circuit, the voltage and current of the RL circuit and the time response of the RC circuit.

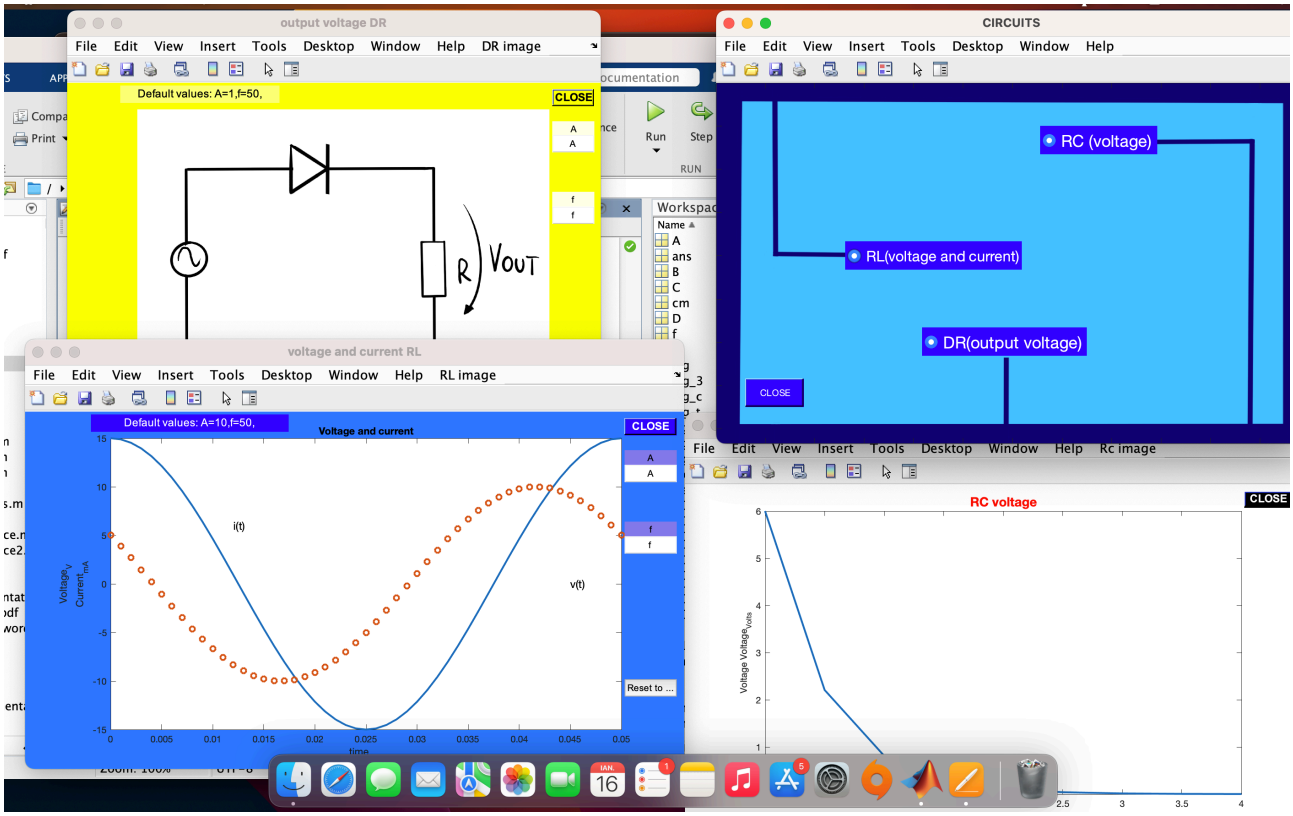


Figure 3

Here are some examples of buttons used.

RADIO BUTTON

```
GO_rb1=uicontrol('Style','radiobutton',...
  'Units','normalized',...
  'Position',[0.55 0.80 0.2 0.08],...
  'backgroundcolor',[0 0 1],...
  'foregroundcolor',[1 1 1],...
  'FontSize',18,...
  'String','RC (voltage)',...
  'Callback','interfataRC');                %the script for the plot
```

EDIT BUTTON

```
uicontrol('Style','edit',...
     'Units','normalized',...
     'Position',[0.91 0.60 0.08 .05],...
     'String','f',...
     'Callback',['f=','str2num(get(gco,''String''));interfata(A,f);']);     &How
to change the frequency
```

TRIGONOMETRIC FUNCTIONS

Figure 4 contains 2 plots using trigonometric functions. There is an animation and some sine and cosine functions. *Figure 5* represents the difference between a sin and a cosine and the difference between two tangents. All the buttons are edit buttons. There is also a button that resets all the values to the initial values.

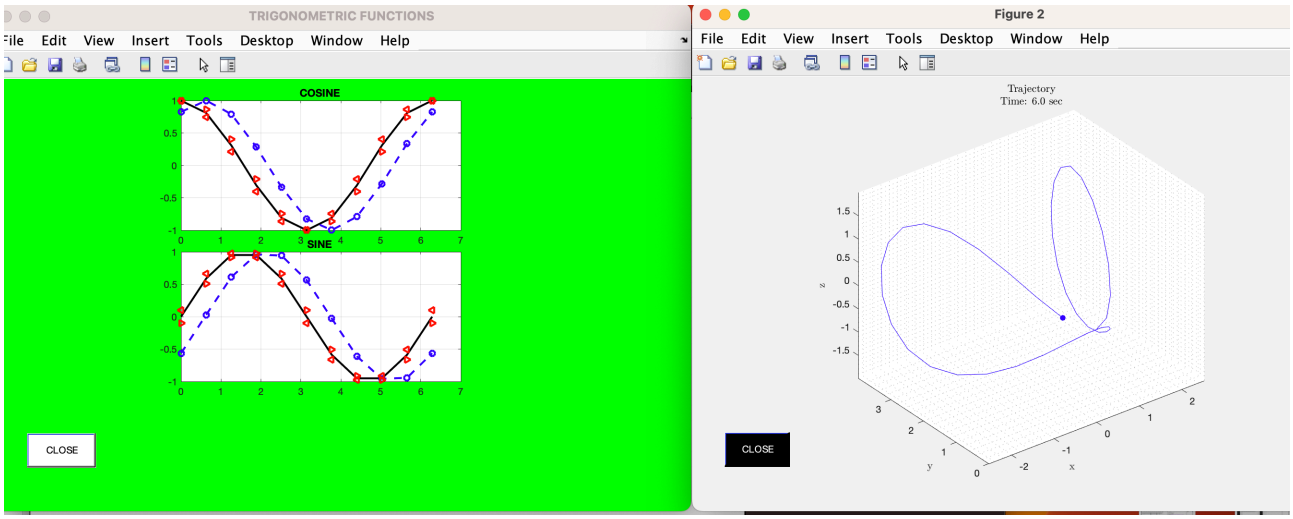


Figure 4

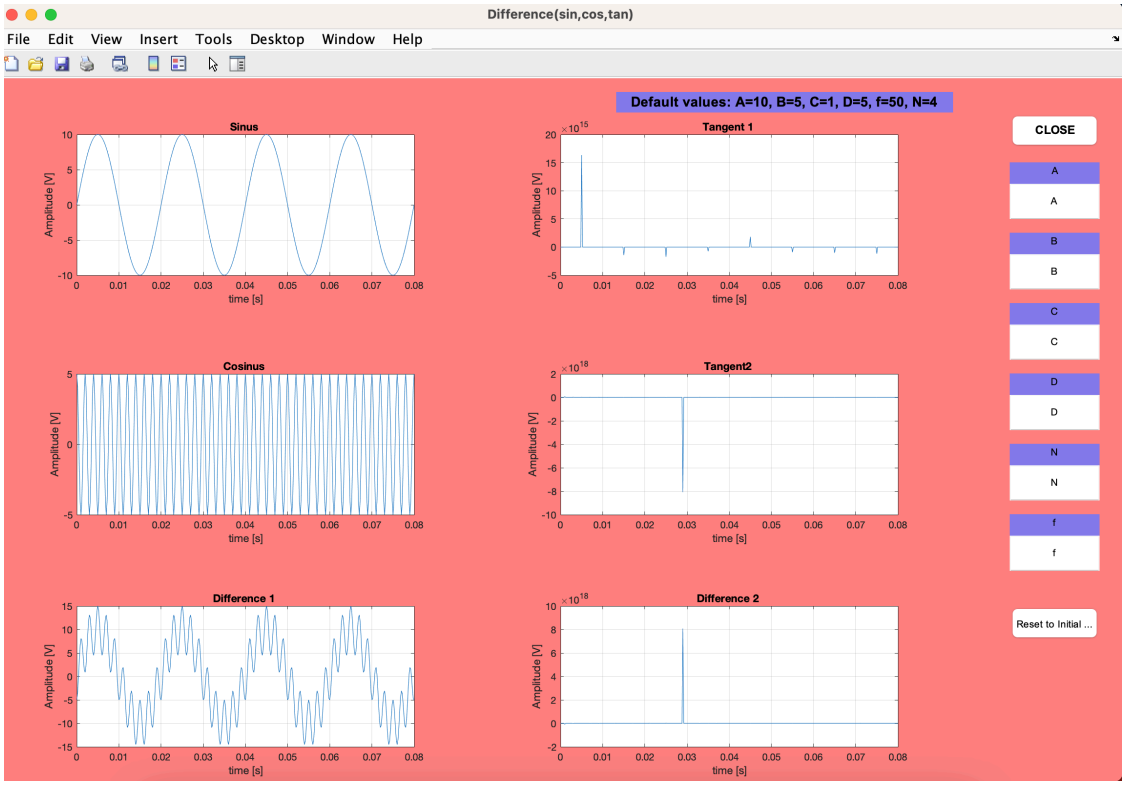


Figure 5

Here is some code of the animation plot.

```
title(sprintf('Trajectory\nTime: %0.1f sec', t(1)), 'Interpreter', 'Latex');
xlabel('x', 'Interpreter', 'Latex')
ylabel('y', 'Interpreter', 'Latex')
zlabel('z', 'Interpreter', 'Latex')

plot3(x,y,z,'Color','none');     %it is plotting the line on the spot
```

ERORS

If the ”gif” isn’t finished, the next error comes up “Error in animation (line 33) p.XData = x(1:k);” which creates another empty figure.

3D PLOTS

Figure 6 shows a 3D cylinder and a mesh grid which has a 2D plot under it.

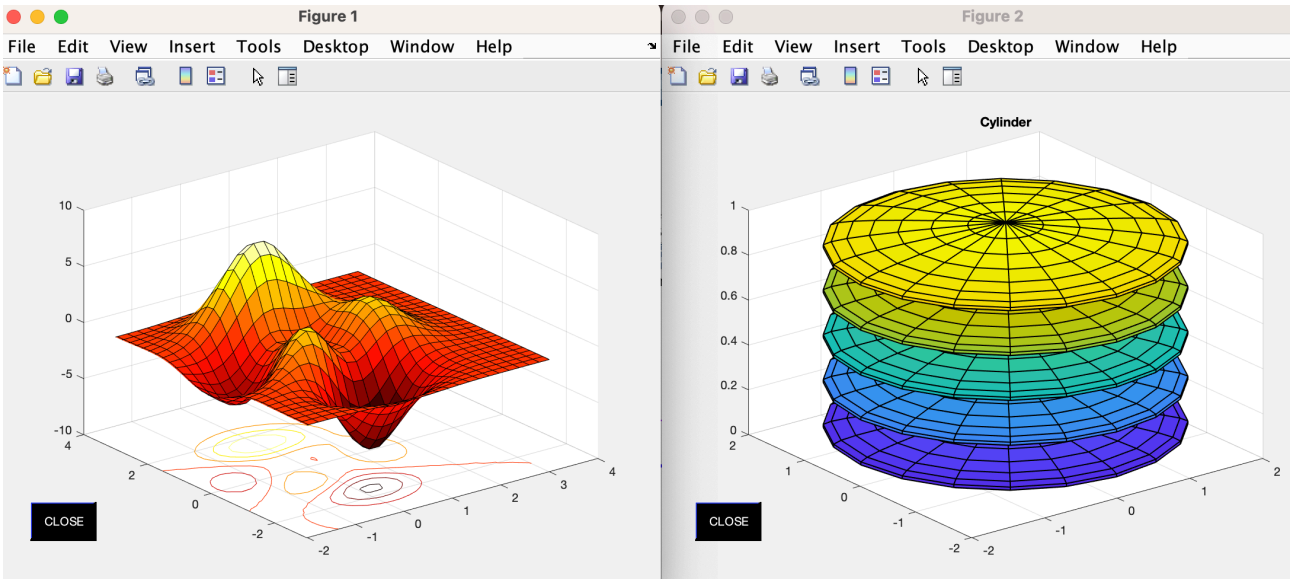


Figure 6

Here is the code for the mesh grid.

```
[X,Y,Z] =peaks(30);

figure

surfc(X,Y,Z)

colormap hot

axis([-2 4 -3 4 -10 10])
```

Figure 7 is an attempt to plot a 4 leaf clove. It is inspired from the formula of a heart plot.

Here is the code for the Leaf.

```
x=linspace(-3,3,n);

y=linspace(-3,3,n);

z=linspace(-3,3,n);

[X,Y,Z]=ndgrid(x,y,z);

F= -X.^2.*Z.^2-
(2/80).*Y.^3.*Z+
(X.^2+60.*Y.^4+Z.^2-0.3).^3;

isosurface(F,0)

lighting phong

clim

axis equal

colormap jet;

view([55 34]);
```

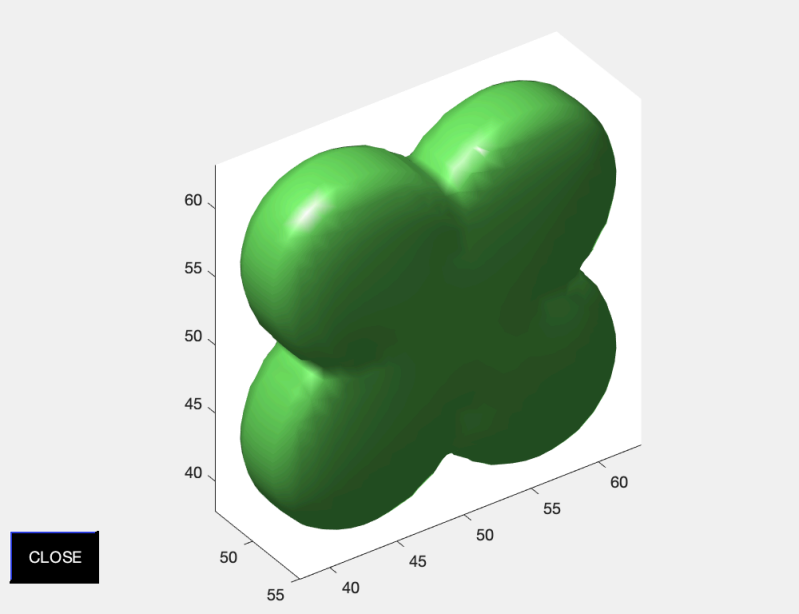


Figure 7

FUNCTIONS

The project also contains functions, such as the functions for opening the documentation. They are:

```
function word_documentation                    %opens the word documentation
open('proiect_gui_word.docx');

function pdf_documentation                     %opens the pdf documentation
open('proiect_gui.pdf');
```

Here is an example of the submenu that opens the pdf function.

```
uimenu(h1,'Label','PDF format','Callback','pdf_documentation');
```

Some other functions are the plots that have edit buttons. They are called: “interfata(A,f)” with the script “main_interface ”, “interfata2(A,f)” with the script “main_interface2 ”, “trig(A,B,f,N,C,D)” with the script “main_trig ”

CONCLUSION

Electronics engineering is a sub-discipline of electrical engineering which emerged in the early 20th century and is distinguished by the additional use of active components such as semiconductor devices to amplify and control electric current flow.

In mathematics, the trigonometric functions (also called circular functions, angle functions or goniometric functions) are real functions which relate an angle of a right-angled triangle to ratios of two side lengths.

In geometry, a three-dimensional space (3D space, 3-space or, rarely, tri-dimensional space) is a mathematical structure in which three values (coordinates) are required to determine the position of a point. More specifically, the three-dimensional space is the Euclidean space of dimemsion three that models physical space.

The theme of the project is Electronics and it contains different types of problems some students may encounter during their study years. It contains circuits, functions with sine, cosine, target and 3D plots.

All in all, the GUI has the purpose of helping students in the Electronic domain, by creating a better point of view of some simple, but important circuits and some trigonometric function. Moreover the 3D plots are meant to help them see how a 3D plot looks like and what they can create with them.

BIBLIOGRAPHY

WIKIPEDIA

https://en.wikipedia.org/wiki/Three-dimensional_space

https://en.wikipedia.org/wiki/Electronic_engineering

https://en.wikipedia.org/wiki/Trigonometric_functions

https://en.wikipedia.org/wiki/Electronics

Books

Matlab for students

APPENDIX

CODE

Main_GUI.m

```
Fig=figure('Name','PROJECT_GUI',...
'Units','normalized',...
'Position',[.06 .1 0.9 0.9],...
'NumberTitle','off');

GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[1 0 0],...
 'foregroundcolor',[1 1 1],...
 'String','CLOSE',...
 'Callback','close');

GO_t=uicontrol('Style','text',...
 'Units','normalized',...
'Position',[0.37 0.82 0.34 0.14],...
'backgroundcolor',[1 0 0],...
'foregroundcolor',[1 1 1],...
'FontWeight','bold',...
'FontSize',60,...
'String','ELECTRONICS');

uicontrol('Style','text',...
  'Units','normalized',...
 'Position',[0.096 0.82 0.17 0.05],...
```

```
 'foregroundcolor','w',...
 'backgroundcolor',[1 0 0],...
 'FontSize',16,...
 'String','Istrate Andreea Maria');

ha = axes('units','normalized',...
    'Position',[0 0 1 1]);
uistack(ha,'bottom');
I=imread('GUI.png');
hi = imagesc(I);



GO_a=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.76 0.58 0.2 0.08],...
 'backgroundcolor',[1 0 0],...
 'foregroundcolor',[1 1 1],...
 'FontSize',18,...
 'String','Circuits',...
 'Callback','main_circuits');

GO_b=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.76 0.43 0.2 0.08],...
 'backgroundcolor',[1 0 0],...
 'foregroundcolor',[1 1 1],...
 'FontSize',16,...
 'String','Trigonometric functions',...
 'Callback','main_trig');

GO_c=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.76 0.28 0.2 0.08],...
```

```
 'backgroundcolor',[1 0 0],...
 'foregroundcolor',[1 1 1],...
 'FontName','Arial',...
 'FontSize',18,...
 'String','3D plots',...
 'Callback','main_3D');

h = uimenu('Label','Main menu');
h1=uimenu(h,'Label','Documentation');
uimenu(h,'Label','Save','Callback','save');
uimenu(h,'Label','Close','Callback','close',...
 'Separator','on','Accelerator','Q');

uimenu(h1,'Label','PDF format','Callback','pdf_documentation');
uimenu(h1,'Label','Word format','Callback','word_documentation');
```

main_circuits.m

```
Fig_c=figure('Name','CIRCUITS',...
'Units','normalized',...
'Position',[.1 .1 .5 .5],...
'NumberTitle','off','color',[0 0.5 1]);

GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[0 0 1],...
 'foregroundcolor',[1 1 1],...
 'String','CLOSE',...
 'Callback','close');
```

```
ha = axes('units','normalized',...
    'Position',[0 0 1 1]);
uistack(ha,'bottom');
I=imread('Circuits.png');
hi = imagesc(I);
colormap gray;

GO_rb1=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.55 0.80 0.2 0.08],...
 'backgroundcolor',[0 0 1],...
 'foregroundcolor',[1 1 1],...
 'FontSize',18,...
 'String','RC (voltage)',...
 'Callback','interfataRC');

GO_rb2=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.22 0.48 0.3 0.08],...
 'backgroundcolor',[0 0 1],...
 'foregroundcolor',[1 1 1],...
 'FontSize',16,...
 'String','RL(voltage and current)',...
 'Callback','main_interface');

GO_rb3=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.35 0.24 0.28 0.08],...
 'backgroundcolor',[0 0 1],...
 'foregroundcolor',[1 1 1],...
 'FontSize',18,...
 'String','DR(output voltage)',...
 'Callback','main_interface2');
```

main_trig.m

```
Fig_t=figure('Name','TRIGONOMETRIC FUNCTIONS',...
'Units','normalized',...
'Position',[.1 .1 .5 .5],...
'NumberTitle','off','color',[0 0.5 1]);

GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[1 0 1],...
 'foregroundcolor',[1 1 1],...
 'String','CLOSE',...
 'Callback','close');

GO_t=uicontrol('Style','text',...
 'Units','normalized',...
'Position',[0.3 0.8 0.2 0.13],...
'backgroundcolor',[1 0.5 1],...
'foregroundcolor',[1 1 1],...
'FontSize',20,...
'String','Trigonometric functions');

ha = axes('units','normalized',...
    'Position',[0 0 1 1]);
uistack(ha,'bottom');
I=imread('Trig.png');
hi = imagesc(I);
colormap gray;
```

```
GO_rb1=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.55 0.80 0.3 0.08],...
 'backgroundcolor',[1 0 1],...
 'foregroundcolor',[1 1 1],...
 'FontSize',14,...
 'String','Difference (sin,cos,tan)',...
 'Callback','main1_trig');

GO_rb2=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.22 0.48 0.15 0.08],...
 'backgroundcolor',[1 0 1],...
 'foregroundcolor',[1 1 1],...
 'FontSize',16,...
 'String','Animation',...
 'Callback','animation');

GO_rb3=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.35 0.24 0.25 0.08],...
 'backgroundcolor',[1 0 1],...
 'foregroundcolor',[1 1 1],...
 'FontSize',16,...
 'String','Cos/Sin overlay',...
 'Callback','main2_trig');
```

main_3D.m

```
Fig_3=figure('Name','3D PLOTS',...
'Units','normalized',...
'Position',[.1 .1 .5 .5],...
'NumberTitle','off');

GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[1 1 0],...
 'foregroundcolor',[0 0 0],...
 'String','CLOSE',...
 'Callback','close');



ha = axes('units','normalized',...
    'Position',[0 0 1 1]);
uistack(ha,'bottom');
I=imread('3D.png');
hi = imagesc(I);
colormap gray;

GO_rb1=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.55 0.80 0.2 0.08],...
 'backgroundcolor',[1 1 0],...
 'foregroundcolor',[0 0 0],...
 'FontSize',18,...
 'String','MESHGRID',...
 'Callback','meshs');
```

```
GO_rb2=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.22 0.48 0.3 0.08],...
 'backgroundcolor',[1 1 0],...
 'foregroundcolor',[0 0 0],...
 'FontSize',16,...
 'String','CYLINDER',...
 'Callback','cylinder1');

GO_rb3=uicontrol('Style','radiobutton',...
 'Units','normalized',...
 'Position',[0.35 0.24 0.28 0.08],...
 'backgroundcolor',[1 1 0],...
 'foregroundcolor',[0 0 0],...
 'FontSize',18,...
 'String','SIMPLE 3D PLOT',...
 'Callback','d3plot');
```

word_documentation.m

```
function word_documentation
open('proiect_gui_word.docx');
```

pdf_documentation.m

```
function pdf_documentation
open('proiect_gui.pdf');
```

main_interface.m

```
A=10;
f=50;
figc=figure('Name','voltage and current RL',...
    'Units','normalized',...
    'NumberTitle','off',...
    'Position',[0.1 0.1 0.5 0.5],...
    'Color',[0. 0.5 1]);

uicontrol('Style','pushbutton',...
    'Units','normalized',...
    'Position',[0.91 0.93 0.08 .05],...
    'string','CLOSE',...
    'backgroundcolor',[0 0 1],...
    'FontName','Arial',...
    'foregroundcolor',[1 1 1],...
    'FontWeight','bold',...
    'FontSize',12,...
    'Callback','close');

uicontrol('Style','text',...
'Units','normalized',...
    'Position',[0.1 0.94 0.3 .05],...
    'Backgroundcolor',[0 0 1],...
    'FontName','Arial',...
    'foregroundcolor',[1 1 1],...
    'FontSize',12,...
    'String','Default values: A=10,f=50,');

interfata(A,f);
```

```
h = uimenu('Label','RL image','Callback','figb');
```

interfata.m

```
function interfata(A,f)
t=0:1e-3:50e-3;
v=A*cos(2*pi*f*t);
a_rad = (60*pi/180);
i=10*cos(2*pi*f*t + a_rad);

uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.91 0.84 0.08 .05],...
    'Backgroundcolor',[0.5 0.5 0.9],...
    'String','A');
 uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.91 0.80 0.08 .05],...
    'String','A',...
    'Callback',['A=','str2num(get(gco,''String''));interfata(A,f);']);

 uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.91 0.64 0.08 .05],...
    'Backgroundcolor',[0.5 0.5 0.9],...
    'String','f');

 uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.91 0.60 0.08 .05],...
    'String','f',...
```

```
    'Callback',['f=','str2num(get(gco,''String''));interfata(A,f);']);

 uicontrol('Style','pushbutton',...
    'Units','normalized',...
    'Position',[0.91 0.2 0.08 .05],...
    'String','Reset to Initial Values',...
    'FontName','Arial',...
    'Callback','interfata(10,50);');

 plot(t,v,t,i,'o','Linewidth',2)
title('Voltage and current')
xlabel('time_{Sec}')
ylabel({'Voltage_{V}','Current_{mA}'})
text(0.045,0, 'v(t)','FontSize', 12);
text(0.012,6, 'i(t)','FontSize', 12);

end
```

main_interface2.m

```
A=1;
f=50;
figc2=figure('Name','output voltage DR',...
    'Units','normalized',...
    'NumberTitle','off',...
    'Position',[0.1 0.1 0.5 0.5],...
    'Color',[1 1 0]);

uicontrol('Style','pushbutton',...
    'Units','normalized',...
    'Position',[0.91 0.93 0.08 .05],...
    'string','CLOSE',...
```

```
    'backgroundcolor',[1 1 0],...
    'FontName','Arial',...
    'foregroundcolor',[0 0 0],...
    'FontWeight','bold',...
    'FontSize',12,...
    'Callback','close');

uicontrol('Style','text',...
'Units','normalized',...
    'Position',[0.1 0.94 0.3 .05],...
    'Backgroundcolor',[1 1 0.5],...
    'FontName','Arial',...
    'foregroundcolor',[0 0 0],...
    'FontSize',12,...
    'String','Default values: A=1,f=50,');
interfata2(A,f);

h = uimenu('Label','DR image','Callback','figc1');
```

Interfata2.m

```
function interfata2(A,f)
t=0:0.001:0.004;
vin=A*sin(2*pi*f*t);
vout = zeros(size(vin));
for i = 1:length(t)
    if(vin(i) >=0)
        vout(i)=vin(i);
    end
end
uicontrol('Style','text',...
    'Units','normalized',...
```

```
    'Position',[0.91 0.84 0.08 .05],...
    'Backgroundcolor',[ 1 1 0.9],...
    'String','A');
uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.91 0.80 0.08 .05],...
    'String','A',...
    'Callback',['A=','str2num(get(gco,''String''));interfata2(A,f);']);
uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.91 0.64 0.08 .05],...
'Backgroundcolor',[1 1 0.9],...
    'String','f');
uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.91 0.60 0.08 .05],...
    'String','f',...
    'Callback',['f=','str2num(get(gco,''String''));interfata2(A,f);']);
uicontrol('Style','pushbutton',...
    'Units','normalized',...
    'Position',[0.91 0.2 0.08 .05],...
    'String','Reset to Initial Values',...
    'FontName','Arial',...
    'Callback','interfata2(1,50);');
plot(t,vout)
xlabel('time_{Sec}')
ylabel({'Amplitude'})
end
```

interfataRC.m

```
Figc3=figure('Name','RC voltage',...
    'Units','normalized',...
    'NumberTitle','off',...
    'Position',[0.1 0.1 0.5 0.5],...
    'Color',[1 1 1]);


t = 0:0.5:4;
v= 6*exp(-2*t);
plot(t,v,'Linewidth',2)
title('RC voltage', 'FontSize', 14,'Color','r')
xlabel('time t_{sec}','FontSize',10)
ylabel('Voltage Voltage_{Volts}','FontSize',10)

uicontrol('Style','pushbutton',...
    'Units','normalized',...
    'Position',[0.91 0.93 0.08 .05],...
    'string','CLOSE',...
    'backgroundcolor',[0 0 0],...
    'FontName','Arial',...
    'foregroundcolor',[1 1 1],...
    'FontWeight','bold',...
    'FontSize',12,...
    'Callback','close');

h = uimenu('Label','Rc image','Callback','figa');
```

figa.m

```
w = imread('RC.png');
imshow(w,'InitialMagnification',150)
```

figb.m

```
w = imread('RL.png');
imshow(w,'InitialMagnification',150)
```

figc.1.m

```
w = imread('DR.png');
imshow(w,'InitialMagnification',150)
```

main1_trig.m

```
A=10;
B=5;
C=1;
D=5;
f=50;
N=4;

Fig=figure('Name','Difference(sin,cos,tan)',...
    'Units','normalized',...
    'NumberTitle','off',...
    'Position',[0.1 0.1 0.8 0.8],...
    'Color',[1 0.5 0.5]);

uicontrol('Style','text',...
```

```
'Units','normalized',...
    'Position',[0.55 0.95 0.3 .03],...
    'Backgroundcolor',[0.5 0.5 0.9],...
    'FontName','Arial',...
    'FontWeight','bold',...
    'FontSize',14,...
    'String','Default values: A=10, B=5, C=1, D=5, f=50, N=4');

trig(A,B,f,N,C,D);
```

trig.m

```
function trig(A,B,f,N,C,D)
T=1/f;
t=0:T/100:N*T;
x1=A*sin(2*pi*f*t);
x2=B*cos(10*2*pi*f*t);
x3=x1-x2;
x4=C*tan(2*pi*f*t);
x5=D*tan(5*2*pi*f*t);
x6=x4-x5;



uicontrol('Style','pushbutton',...
    'Units','normalized',...
    'Position',[0.9 0.9 0.08 .05],...
    'string','CLOSE',...
    'FontName','Arial',...
    'FontWeight','bold',...
    'FontSize',12,...
    'Callback','close');
```

```
uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.9 0.83 0.08 .05],...
    'Backgroundcolor',[0.5 0.5 0.9],...
    'String','A');

uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.9 0.80 0.08 .05],...
    'String','A',...
    'Callback',['A=','str2num(get(gco,''String''));trig(A,B,f,N,C,D);']);

uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.9 0.63 0.08 .05],...
    'Backgroundcolor',[0.5 0.5 0.9],...
    'String','C');

uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.9 0.60 0.08 .05],...
'String','C',...
    'Callback',['C=','str2num(get(gco,''String''));trig(A,B,f,N,C,D);']);

uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.9 0.53 0.08 .05],...
    'Backgroundcolor',[0.5 0.5 0.9],...
    'String','D');

uicontrol('Style','edit',...
    'Units','normalized',...
```

```
    'Position',[0.9 0.50 0.08 .05],...
    'String','D',...
    'Callback',['D=','str2num(get(gco,''String''));trig(A,B,f,N,C,D);']);

uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.9 0.73 0.08 .05],...
    'backgroundcolor',[0.5 0.5 0.9],...
    'string','B');

uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.9 0.70 0.08 .05],...
    'String','B',...
    'Callback',['B=','str2num(get(gco,''String''));trig(A,B,f,N,C,D)']);

uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.9 0.33 0.08 .05],...
    'Backgroundcolor',[0.5 0.5 0.9],...
    'String','f');

uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.9 0.30 0.08 .05],...
    'String','f',...
    'Callback',['f=','str2num(get(gco,''String''));trig(A,B,f,N,C,D)']);

uicontrol('Style','text',...
    'Units','normalized',...
    'Position',[0.9 0.43 0.08 .05],...
    'Backgroundcolor',[0.5 0.5 0.9],...
    'String','N');
```

```
uicontrol('Style','edit',...
    'Units','normalized',...
    'Position',[0.9 0.40 0.08 .05],...
    'String','N',...
    'Callback',['N=','str2num(get(gco,''String''));trig(A,B,f,N,C,D)']);

uicontrol('Style','pushbutton',...
    'Units','normalized',...
    'Position',[0.9 0.2 0.08 .05],...
    'String','Reset to Initial Values',...
    'FontName','Arial',...
    'Callback','trig(10,5,50,4,10,5);');

subplot('position',[0.07 0.72 0.3 0.20]);
plot(t,x1);
grid on;
title('Sinus ');
xlabel('time [s]');
ylabel('Amplitude [V]');

subplot('position',[0.07 0.38 0.3 0.20]);
plot(t,x2);
grid on;
title('Cosinus ');
xlabel('time [s]');
ylabel('Amplitude [V]');

subplot('position',[0.07 0.05 0.3 0.20]);
plot(t,x3);
grid on;
title('Difference 1 ');
xlabel('time [s]');
```

```
ylabel('Amplitude [V]');

subplot('position',[0.5 0.72 0.3 0.20]);
plot(t,x4);
grid on;
title('Tangent 1 ');
xlabel('time [s]');
ylabel('Amplitude [V]');

subplot('position',[0.5 0.38 0.3 0.20]);
plot(t,x5);
grid on;
title('Tangent2 ');
xlabel('time [s]');
ylabel('Amplitude [V]');

subplot('position',[0.5 0.05 0.3 0.20]);
plot(t,x6);
grid on;
title('Difference 2 ');
xlabel('time [s]');
ylabel('Amplitude [V]');

end
```

main2_trig.m

```
Fig_t=figure('Name','TRIGONOMETRIC FUNCTIONS',...
'Units','normalized',...
'Position',[.1 .1 .5 .5],...
'NumberTitle','off','color',[0 1 0]);
```

```
GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[1 1 1],...
 'foregroundcolor',[0 0 0],...
 'String','CLOSE',...
 'Callback','close');
x=0:pi/5:2*pi;
y1=cos(x);
y2=cos(x-0.60);
y3=cos(x-0.10);
y4=cos(x+0.10);

x=0:pi/5:2*pi;
z1=sin(x);
z2=sin(x-0.60);
z3=sin(x-0.10);
z4=sin(x+0.10);



subplot('position',[0.27 0.65 0.4 0.30]);
plot(x,y1,'k',x,y2,'b--o',x,y3,'r>',x,y4,'r<','LineWidth',2)
grid on;
title('COSINE ');

subplot('position',[0.27 0.3 0.4 0.30]);
plot(x,z1,'k',x,z2,'b--o',x,z3,'r>',x,z4,'r<','LineWidth',2)
grid on;
title('SINE ');
```

meshs.m

```
[X,Y,Z] =peaks(30);
figure
surfc(X,Y,Z)
colormap hot
axis([-2 4 -3 4 -10 10])

GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[0 0 0],...
 'foregroundcolor',[1 1 1],...
 'String','CLOSE',...
 'Callback','close');
```

cylinder1.m

```
t=0:pi/15:5*pi;
figure
[X,Y,Z]=cylinder(2*sin(t));
surf(X,Y,Z,'LineWidth',1)
title('Cylinder')

GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[0 0 0],...
 'foregroundcolor',[1 1 1],...
 'String','CLOSE',...
```

```
 'Callback','close');
```

D3plot.m

```
figure
n=100;
x=linspace(-3,3,n);
y=linspace(-3,3,n);
z=linspace(-3,3,n);
[X,Y,Z]=ndgrid(x,y,z);
F= -X.^2.*Z.^2-(2/80).*Y.^3.*Z+(X.^2+60.*Y.^4+Z.^2-0.3).^3;
isosurface(F,0)
lighting phong
clim
axis equal
colormap jet;
view([55 34]);


GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[0 0 0],...
 'foregroundcolor',[1 1 1],...
 'String','CLOSE',...
 'Callback','close');
```

animation.m

```
t = linspace(0, 6, 40);
x = 2*sin(t);
y = x.^2;
```

```
z = y.*cos(t);


figure; hold on
title(sprintf('Trajectory\nTime: %0.1f sec', t(1)), 'Interpreter', 'Latex');
xlabel('x', 'Interpreter', 'Latex')
ylabel('y', 'Interpreter', 'Latex')
zlabel('z', 'Interpreter', 'Latex')
grid minor
axis equal
view(-37.5,30);

GO_p=uicontrol('Style','pushbutton',...
 'Units','normalized',...
 'Position',[0.05 0.1 0.1 0.08],...
 'backgroundcolor',[0 0 0],...
 'foregroundcolor',[1 1 1],...
 'String','CLOSE',...
 'Callback','close');



filename = 'animation.gif';


plot3(x,y,z,'Color','none');


p = plot3(x(1),y(1),z(1),'b');
m = scatter3(x(1),y(1),z(1),'filled','b');


for k = 1:length(t)


    p.XData = x(1:k);
    p.YData = y(1:k);
    p.ZData = z(1:k);
```

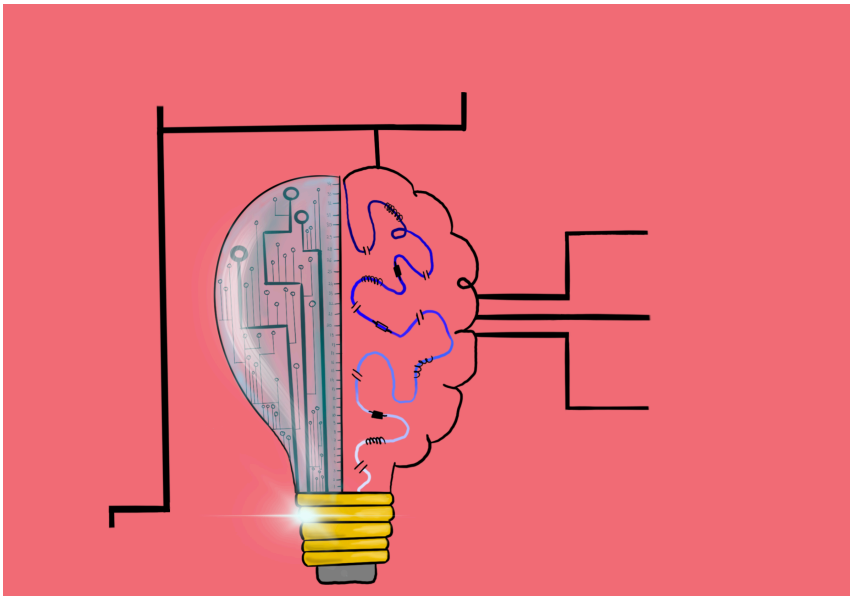
```
    m.XData = x(k);
    m.YData = y(k);
    m.ZData = z(k);

    title(sprintf('Trajectory\nTime: %0.1f sec', t(k)),...
    'Interpreter','Latex');

    pause(0.01)

    frame = getframe(gcf);
    im = frame2im(frame);
    [imind,cm] = rgb2ind(im,256);
    if k == 1
        imwrite(imind,cm,filename,'gif', 'Loopcount',inf,...
        'DelayTime',0.1);
    else
        imwrite(imind,cm,filename,'gif','WriteMode','append',...
        'DelayTime',0.1);
    end
end
```

IMAGES

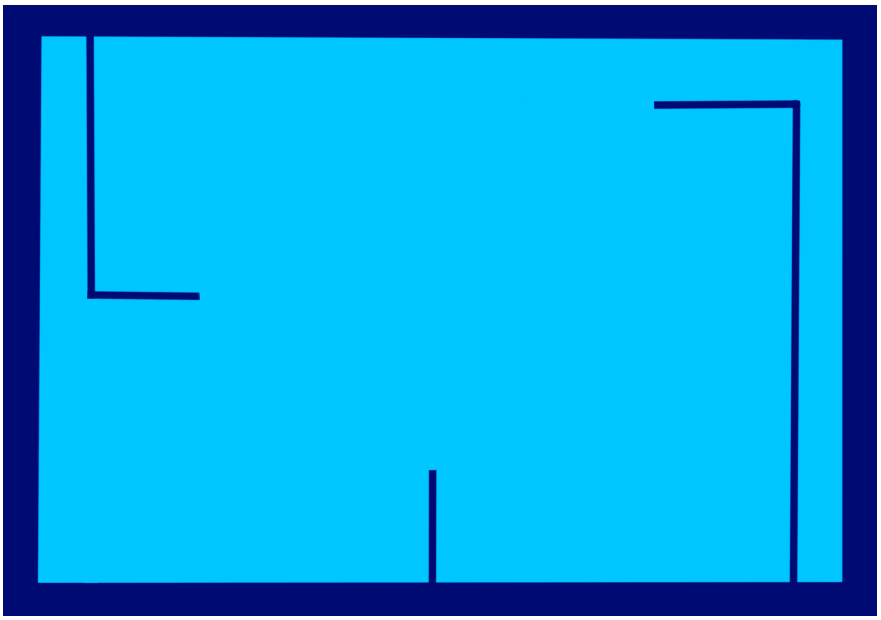
Here are the images needed

for the GUI to work properly.

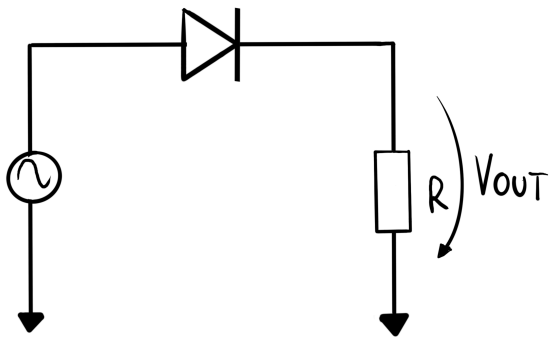
GUI.png



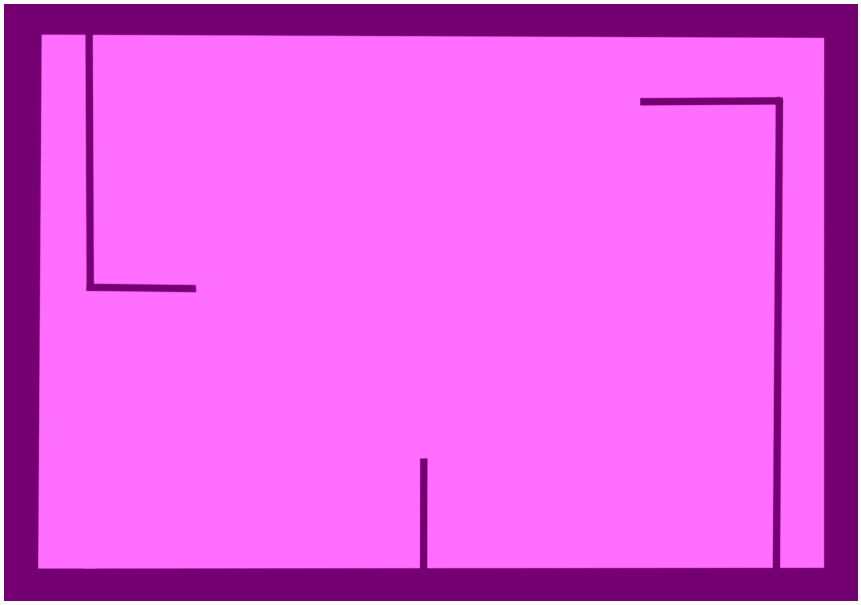
Circuits.png



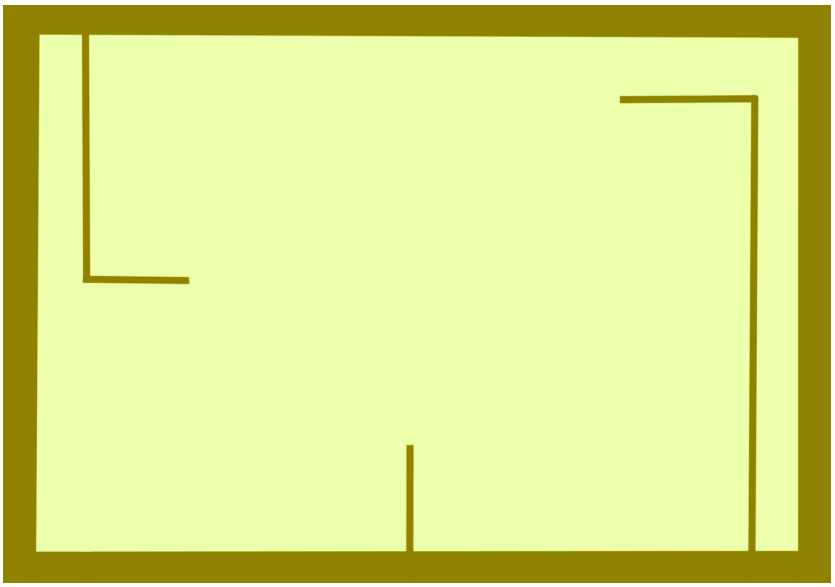
DR.png



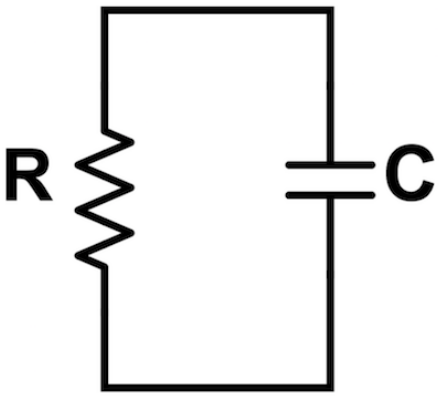
Trig.png



3D.png



RC.png



RL.png