GRADO EN INGENIERÍA EN TECNOLOGÍA INDUSTRIAL

TRABAJO FIN DE GRADO

CÁLCULO Y ANÁLISIS DEL EFECTO FERRANTI EN TRANSFORMADORES

DOCUMENTO 1- CÓDIGO DE LA INTERFAZ GRÁFICA DE USUARIO

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```matlab
function varargout = Calculo_Ferranti(varargin)
% CALCULO_FERRANTI MATLAB code for Calculo_Ferranti.fig
%      CALCULO_FERRANTI, by itself, creates a new CALCULO_FERRANTI or raises the existing
%      singleton*.
%
%      H = CALCULO_FERRANTI returns the handle to a new CALCULO_FERRANTI or the handle to
%      the existing singleton*.
%
%      CALCULO_FERRANTI('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in CALCULO_FERRANTI.M with the given input arguments.
%
%      CALCULO_FERRANTI('Property','Value',...) creates a new CALCULO_FERRANTI or raises the
%      existing singleton*.  Starting from the left, property value pairs are
%      applied to the GUI before Calculo_Ferranti_OpeningFcn gets called.  An
%      unrecognized property name or invalid value makes property application
%      stop.  All inputs are passed to Calculo_Ferranti_OpeningFcn via varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows only one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% Edit the above text to modify the response to help Calculo_Ferranti

% Last Modified by GUIDE v2.5 30-Mar-2018 22:41:47

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @Calculo_Ferranti_OpeningFcn, ...
                   'gui_OutputFcn',  @Calculo_Ferranti_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT


% --- Executes just before Calculo_Ferranti is made visible.
function Calculo_Ferranti_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to Calculo_Ferranti (see VARARGIN)

% Choose default command line output for Calculo_Ferranti
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes Calculo_Ferranti wait for user response (see UIRESUME)
% uiwait(handles.figure1);


% --- Outputs from this function are returned to the command line.
function varargout = Calculo_Ferranti_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;


% --------------------------------------------------------------------
function panel_datos_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to panel_datos (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

```matlab
% --- Executes when panel_datostrafo is resized.
function panel_datostrafo_SizeChangedFcn(hObject, eventdata, handles)
% hObject    handle to panel_datostrafo (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


function tens_nom1_Callback(hObject, eventdata, handles)
% hObject    handle to tens_nom1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of tens_nom1 as text
%        str2double(get(hObject,'String')) returns contents of tens_nom1 as a double


% --- Executes during object creation, after setting all properties.
function tens_nom1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to tens_nom1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%        See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function tens_nom2_Callback(hObject, eventdata, handles)
% hObject    handle to tens_nom2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of tens_nom2 as text
%        str2double(get(hObject,'String')) returns contents of tens_nom2 as a double


% --- Executes during object creation, after setting all properties.
function tens_nom2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to tens_nom2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%        See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function potap_nom_Callback(hObject, eventdata, handles)
% hObject    handle to potap_nom (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of potap_nom as text
%        str2double(get(hObject,'String')) returns contents of potap_nom as a double


% --- Executes during object creation, after setting all properties.
function potap_nom_CreateFcn(hObject, eventdata, handles)
% hObject    handle to potap_nom (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%        See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function resis1_Callback(hObject, eventdata, handles)
```

```matlab
% hObject    handle to resis1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of resis1 as text
%        str2double(get(hObject,'String')) returns contents of resis1 as a double


% --- Executes during object creation, after setting all properties.
function resis1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to resis1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function admit1_Callback(hObject, eventdata, handles)
% hObject    handle to admit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of admit1 as text
%        str2double(get(hObject,'String')) returns contents of admit1 as a double


% --- Executes during object creation, after setting all properties.
function admit1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to admit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function resis2_Callback(hObject, eventdata, handles)
% hObject    handle to resis2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of resis2 as text
%        str2double(get(hObject,'String')) returns contents of resis2 as a double


% --- Executes during object creation, after setting all properties.
function resis2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to resis2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function admit2_Callback(hObject, eventdata, handles)
% hObject    handle to admit2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of admit2 as text
%        str2double(get(hObject,'String')) returns contents of admit2 as a double


% --- Executes during object creation, after setting all properties.
function admit2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to admit2 (see GCBO)
```

```matlab
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --- Executes when panel_datoscarga is resized.
function panel_datoscarga_SizeChangedFcn(hObject, eventdata, handles)
% hObject    handle to panel_datoscarga (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


% --- Executes on button press in checkbox_potap.
function checkbox_potap_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox_potap (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox_potap

% SE HABILITA LA OPCIOÓN DE INTRODUCIR EL DATO DE POTENCIA APARENTE

checkboxpotapStatus = get(handles.checkbox_potap,'Value');

if checkboxpotapStatus == 1

    set(handles.potap_carga,'Enable','on');

    set(handles.intens_carga,'Enable','off');
    set(handles.checkbox_intens,'Value',0);
    set(handles.intens_carga,'String','');

    set(handles.indice_carga,'Enable','off');
    set(handles.checkbox_indicecarga,'Value',0);
    set(handles.indice_carga,'String','');

    set(handles.checkbox_Pcos,'Value',0);
    set(handles.Pact,'Enable','off');
    set(handles.Pact,'String','');

else

    set(handles.potap_carga,'Enable','off');
    set(handles.potap_carga,'String','');

end

function potap_carga_Callback(~, eventdata, handles)
% hObject    handle to potap_carga (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of potap_carga as text
%        str2double(get(hObject,'String')) returns contents of potap_carga as a double


% --- Executes during object creation, after setting all properties.
function potap_carga_CreateFcn(hObject, eventdata, handles)
% hObject    handle to potap_carga (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --- If Enable == 'on', executes on mouse press in 5 pixel border.
% --- Otherwise, executes on mouse press in 5 pixel border or over checkbox_potap.
function checkbox_potap_ButtonDownFcn(hObject, eventdata, handles)
% hObject    handle to checkbox_potap (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

```matlab
% --- Executes on button press in checkbox_intens.
function checkbox_intens_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox_intens (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% Hint: get(hObject,'Value') returns toggle state of checkbox_intens

% SE HABILITA LA OPCIÓN DE INTRODUCIR EL DATO DE INTENSIDAD

checkboxintensStatus = get(handles.checkbox_intens,'Value');

if checkboxintensStatus == 1

    set(handles.intens_carga,'Enable','on');

    set(handles.potap_carga,'Enable','off');
    set(handles.checkbox_potap,'Value',0);
    set(handles.potap_carga,'String','');

    set(handles.indice_carga,'Enable','off');
    set(handles.checkbox_indicecarga,'Value',0);
    set(handles.indice_carga,'String','');

    set(handles.checkbox_Pcos,'Value',0);
    set(handles.Pact,'Enable','off');
    set(handles.Pact,'String','');

else

    set(handles.intens_carga,'Enable','off');
    set(handles.intens_carga,'String','');

end

% --- Executes on button press in checkbox_indicecarga.
function checkbox_indicecarga_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox_indicecarga (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
% Hint: get(hObject,'Value') returns toggle state of checkbox_indicecarga

%SE HABILITA OPCIÓN DE INTRODUCIR EL DATO DE INDICE DE CARGA

checkboxindcargaStatus = get(handles.checkbox_indicecarga,'Value');

if checkboxindcargaStatus == 1

    set(handles.indice_carga,'Enable','on');

    set(handles.potap_carga,'Enable','off');
    set(handles.checkbox_potap,'Value',0);
    set(handles.potap_carga,'String','');

    set(handles.intens_carga,'Enable','off');
    set(handles.checkbox_intens,'Value',0);
    set(handles.intens_carga,'String','');

    set(handles.checkbox_Pcos,'Value',0);
    set(handles.Pact,'Enable','off');
    set(handles.Pact,'String','');

else

    set(handles.indice_carga,'Enable','off');
    set(handles.indice_carga,'String','');

end


function intens_carga_Callback(hObject, eventdata, handles)
% hObject    handle to intens_carga (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of intens_carga as text
%        str2double(get(hObject,'String')) returns contents of intens_carga as a double
```

```matlab
% --- Executes during object creation, after setting all properties.
function intens_carga_CreateFcn(hObject, eventdata, handles)
% hObject    handle to intens_carga (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function indice_carga_Callback(hObject, eventdata, handles)
% hObject    handle to indice_carga (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of indice_carga as text
%        str2double(get(hObject,'String')) returns contents of indice_carga as a double


% --- Executes during object creation, after setting all properties.
function indice_carga_CreateFcn(hObject, eventdata, handles)
% hObject    handle to indice_carga (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


%-------------------------------------------------------------------------
%--------------------------PUSH CALCULAR ---------------------------------
%-------------------------------------------------------------------------
% --- Executes on button press in push_calcferr.
function push_calcferr_Callback(hObject, eventdata, handles)
% hObject    handle to push_calcferr (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% PRIMERO SE OBTIENE EL VALOR NUMERICO DE LOS DATOS DEL TRAFO

V1Nk = str2double(get(handles.tens_nom1,'String'));
V2Nk = str2double(get(handles.tens_nom2,'String'));
SNk  = str2double(get(handles.potap_nom,'String'));
cosfi = str2double(get(handles.cosfii,'String'));
V1N = V1Nk*1000;
V2N = V2Nk*1000;
SN  = SNk*1000;

I1N = SN/V1N;
I2N = SN/V2N;

a = V1N/V2N;

checkboximpeqStatus = get(handles.checkbox_impeq,'Value');


if checkboximpeqStatus == 1

    Re = str2double(get(handles.resisEq,'String'));
    Xe = str2double(get(handles.admitEq,'String'));

else

    R1 = str2double(get(handles.resis1,'String'));
    R2 = str2double(get(handles.resis2,'String'));
    X1 = str2double(get(handles.admit1,'String'));
    X2 = str2double(get(handles.admit2,'String'));

    assignin ('base','R1',R1);
    assignin ('base','R2',R2);
    assignin ('base','X1',X1);
    assignin ('base','X2',X2);
```

```matlab
    R2p = R2*(a^2);
    X2p = X2*(a^2);

    Re = R1 + R2p;
    Xe = X1 + X2p;

end

    Ze = sqrt((Re^2)+(Xe^2));
% DEPENDEDIENDO EL DATO DE CARGA INTRODUCIDO CALCULAR DE UNA MANERA U OTRA
% EL INDICE DE CARGA Y LA INTESIDAD

checkboxpotapStatus = get (handles.checkbox_potap,'Value');
checkboxintensStatus = get(handles.checkbox_intens,'Value');
checkboxindcargaStatus = get(handles.checkbox_indicecarga,'Value');
checkboxPcosStatus = get(handles.checkbox_Pcos,'Value');

if checkboxpotapStatus == 1

    Sk = str2double(get(handles.potap_carga,'String'));

    S = Sk*1000;
    i = S/SN;
    I2p = i*I1N;

end

if checkboxintensStatus == 1

    I2 = str2double(get(handles.intens_carga,'String'));

    I2p = I2/a;

    i = I2p/I1N;

end

if checkboxindcargaStatus == 1

    i = str2double(get(handles.indice_carga,'String'));

    I2p = i*I1N;

end

if checkboxPcosStatus == 1

    Pk = str2double(get(handles.Pact,'String'));

    P = Pk*1000;
    S = P/cosfi;
    i = S/SN;
    I2p = i*I1N;

end


alfa = atan (Re/Xe);
beta = acos ((Ze*I2p)/(2*V1N));

firad = (pi/2)-(beta-alfa);

angferr = (firad*180)/pi;


% TNESIÓN EN EL SECUNDARIO (V2) Y COEFICIENTE DE VARIACION DE TENSIÓN (u)

fi = acos(cosfi);
sinfi = sin(fi);

uR = ((Re*I1N)/V1N)*100;
uX = ((Xe*I1N)/V1N)*100;

% Diferencio entre carga inductiva o capacitiva se calcula u

checkboxinductivaStatus = get(handles.checkbox_induct,'Value');
checkboxcapacitivaStatus = get(handles.checkbox_capacit,'Value');

if checkboxinductivaStatus == 1
```

```matlab
    u = i*(uR*cosfi + uX*sinfi) + ((i^2)/200)*((uX*cosfi - uR*sinfi)^2);

end

if checkboxcapacitivaStatus == 1

    u = i*(uR*cosfi - uX*sinfi) + ((i^2)/200)*((uX*cosfi + uR*sinfi)^2);
    set(handles.angferranti,'Enable','on');
end

if cosfi == 1

   u = i*(uR*cosfi - uX*sinfi) + ((i^2)/200)*((uX*cosfi + uR*sinfi)^2);
end

% Una vez calculado u se cálcula V2

V2 = V2N*(1 - (u/100));

if V2 > V2N

    str1 = 'SE PRODUCE EFECTO FERRANTI';
    set(handles.anuncio_ferranti,'String',str1);

else

    str2 = 'No se produce Efecto Ferranti';
    set(handles.anuncio_ferranti,'String',str2);

end

% ----------------SE MUESTRAN TODOS LOS RESULTADOS--------------------

if angferr > 90

    opts = struct('WindowStyle','modal','Interpreter','tex');
    errordlg('\fontsize{15}\fontname{Calibri} \Phi > 90º, no se produce Efecto Ferranti',...
        'ERROR',opts);

    set(handles.angferranti,'String','');

    clear angferr

end

if i > 1

    opts1 = struct('WindowStyle','modal','Interpreter','tex');
    errordlg('\fontsize{15}\fontname{Calibri} Indice de carga (i) mayor que 1',...
        'ERROR',opts1);

    set(handles.angferranti,'String','');
    set(handles.tens_2,'String','');
    set(handles.coefvar_u,'String','');
    set(handles.anuncio_ferranti,'String','');

    clear angferr
    clear V2
    clear u

elseif i < 0

    opts1 = struct('WindowStyle','modal','Interpreter','tex');
    errordlg('\fontsize{15}\fontname{Calibri} Indice de carga (i) menor que 0',...
        'ERROR',opts1);

    set(handles.angferranti,'String','');
    set(handles.tens_2,'String','');
    set(handles.coefvar_u,'String','');
    set(handles.anuncio_ferranti,'String','');


    clear angferr
    clear V2
    clear u

elseif cosfi > 1

    opts1 = struct('WindowStyle','modal','Interpreter','tex');
```

```matlab
        errordlg('\fontsize{15}\fontname{Calibri} FDP mayor que 1',...
            'ERROR',opts1);

        set(handles.angferranti,'String','');
        set(handles.tens_2,'String','');
        set(handles.coefvar_u,'String','');
        set(handles.anuncio_ferranti,'String','');

        clear angferr
        clear V2
        clear u

    elseif cosfi < 0

        opts1 = struct('WindowStyle','modal','Interpreter','tex');
        errordlg('\fontsize{15}\fontname{Calibri} FDP menor que 0',...
            'ERROR',opts1);

        set(handles.angferranti,'String','');
        set(handles.tens_2,'String','');
        set(handles.coefvar_u,'String','');
        set(handles.anuncio_ferranti,'String','');

        clear angferr
        clear V2
        clear u

elseif checkboxinductivaStatus == 1

        set(handles.angferranti,'Enable','off');
        set(handles.angferranti,'String','')
        set(handles.coefvar_u,'String',num2str(u));
        set(handles.tens_2,'String',num2str(V2));

elseif cosfi == 1

        set(handles.angferranti,'Enable','off');
        set(handles.angferranti,'String','')
        set(handles.coefvar_u,'String',num2str(u));
        set(handles.tens_2,'String',num2str(V2));

else

        set(handles.angferranti,'String',num2str(angferr));
        set(handles.coefvar_u,'String',num2str(u));
        set(handles.tens_2,'String',num2str(V2));

        assignin ('base','angferr',angferr);


end

% PASAMOS TODAS LAS VARIABLE AL WORKSPACE

assignin ('base','V1N',V1N);
assignin ('base','V2N',V2N);
assignin ('base','SN',SN);
assignin ('base','I1N',I1N);
assignin ('base','I2N',I2N);
assignin ('base','Re',Re);
assignin ('base','Xe',Xe);
assignin ('base','Ze',Ze);
assignin ('base','I2p',I2p);
assignin ('base','i',i);


%-------------------------------------------------------------------------
%-------------------------------PUSH DIBUJAR -----------------------------
%-------------------------------------------------------------------------
% --- Executes on button press in push_dibujar.
function push_dibujar_Callback(hObject, eventdata, handles)
% hObject    handle to push_dibujar (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% PRIMERO SE OBTIENE EL VALOR NUMERICO DE LOS DATOS DEL TRAFO

V1Nk = str2double(get(handles.tens_nom1,'String'));
V2Nk = str2double(get(handles.tens_nom2,'String'));
SNk  = str2double(get(handles.potap_nom,'String'));
```

```matlab
cosfi = str2double(get(handles.cosfii,'String'));
a = V1Nk/V2Nk;

V1N = V1Nk*1000;
SN  = SNk*1000;

I1N = SN/V1N;

checkboximpeqStatus = get(handles.checkbox_impeq,'Value');


if checkboximpeqStatus == 1

    Re = str2double(get(handles.resisEq,'String'));
    Xe = str2double(get(handles.admitEq,'String'));

else

    R1 = str2double(get(handles.resis1,'String'));
    R2 = str2double(get(handles.resis2,'String'));
    X1 = str2double(get(handles.admit1,'String'));
    X2 = str2double(get(handles.admit2,'String'));

    R2p = R2*(a^2);
    X2p = X2*(a^2);

    Re = R1 + R2p;
    Xe = X1 + X2p;

end

    Ze = sqrt((Re^2)+(Xe^2));

    % DEPENDEDIENDO EL DATO DE CARGA INTRODUCIDO CALCULAR DE UNA MANERA U OTRA
% EL INDICE DE CARGA Y LA INTESIDAD


checkboxpotapStatus = get (handles.checkbox_potap,'Value');
checkboxintensStatus = get(handles.checkbox_intens,'Value');
checkboxindcargaStatus = get(handles.checkbox_indicecarga,'Value');
checkboxPcosStatus = get(handles.checkbox_Pcos,'Value');

if checkboxpotapStatus == 1

    Sk = str2double(get(handles.potap_carga,'String'));

    S = Sk*1000;
    i = S/SN;
    I2p = i*I1N;

    alfa = atan (Re/Xe);
    beta = acos ((Ze*I2p)/(2*V1N));

    firad = (pi/2)-(beta-alfa);

    angferr = (firad*180)/pi;

end

if checkboxintensStatus == 1

    I2 = str2double(get(handles.intens_carga,'String'));

    I2p = I2/a;

    i = I2p/I1N;

    alfa = atan (Re/Xe);
    beta = acos ((Ze*I2p)/(2*V1N));

    firad = (pi/2)-(beta-alfa);

    angferr = (firad*180)/pi;

end

if checkboxindcargaStatus == 1
```

```matlab
        i = str2double(get(handles.indice_carga,'String'));

        I2p = i*I1N;

        alfa = atan (Re/Xe);
        beta = acos ((Ze*I2p)/(2*V1N));

        firad = (pi/2)-(beta-alfa);

        angferr = (firad*180)/pi;
end

if checkboxPcosStatus == 1

        Pk = str2double(get(handles.Pact,'String'));

        P = Pk*1000;
        S = P/cosfi;
        i = S/SN;
        I2p = i*I1N;

        alfa = atan (Re/Xe);
        beta = acos ((Ze*I2p)/(2*V1N));

        firad = (pi/2)-(beta-alfa);

        angferr = (firad*180)/pi;
end


% SE DIBUJA LA VARIACIÓN DEL ANGULO DE FERRANTI EN FUNCIÓN DEL IND DE CARGA

angferrExist = exist('angferr','var');

ii = 0:0.05:1;

I2pp = ii*I1N;

alfa1 = atan (Re/Xe);
beta1 = acos ((Ze*I2pp)/(2*V1N));

firad1 = (pi/2)-(beta1-alfa1);

angferr1 = (firad1*180)/pi;

angferr1Exist = exist('angferr1','var');

if angferr1Exist == 1

        plot (ii,angferr1,'r');
end

if angferrExist == 1

        plot (ii,angferr1,'r',i,angferr,'bo');

end

ylabel ('Angulo Ferranti','FontSize',14,'FontName','Calibri');
xlabel ('Indice de carga','FontSize',14,'FontName','Calibri');
grid on
%-------------------------------------------------------------------------
%-------------------------------------------------------------------------


function angferranti_Callback(hObject, eventdata, handles)
% hObject    handle to angferranti (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of angferranti as text
%        str2double(get(hObject,'String')) returns contents of angferranti as a double


% --- Executes during object creation, after setting all properties.
function angferranti_CreateFcn(hObject, eventdata, handles)
% hObject    handle to angferranti (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called
```

```matlab
% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end

% --- Executes on button press in checkbox_impeq.
function checkbox_impeq_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox_impeq (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox_impeq

% SE HABILITA OPCIÓN DE INTRODUCIR LOS DATOS DE LA IMPEDANCIA EQUIVALENTE


checkboximpeqStatus = get(handles.checkbox_impeq,'Value');


if checkboximpeqStatus == 1

    set(handles.resisEq,'Enable','on');
    set(handles.admitEq,'Enable','on');

    set(handles.resis1,'Enable','off');
    set(handles.resis2,'Enable','off');
    set(handles.admit1,'Enable','off');
    set(handles.admit2,'Enable','off');
    set(handles.resis1,'String','');
    set(handles.admit1,'String','');
    set(handles.resis2,'String','');
    set(handles.admit2,'String','');

else

    set(handles.resisEq,'Enable','off');
    set(handles.admitEq,'Enable','off');
    set(handles.resisEq,'String','');
    set(handles.admitEq,'String','');

    set(handles.resis1,'Enable','on');
    set(handles.resis2,'Enable','on');
    set(handles.admit1,'Enable','on');
    set(handles.admit2,'Enable','on');

end

function resisEq_Callback(hObject, eventdata, handles)
% hObject    handle to resisEq (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of resisEq as text
%        str2double(get(hObject,'String')) returns contents of resisEq as a double


% --- Executes during object creation, after setting all properties.
function resisEq_CreateFcn(hObject, eventdata, handles)
% hObject    handle to resisEq (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function admitEq_Callback(hObject, eventdata, handles)
% hObject    handle to admitEq (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of admitEq as text
%        str2double(get(hObject,'String')) returns contents of admitEq as a double
```

```matlab
% --- Executes during object creation, after setting all properties.
function admitEq_CreateFcn(hObject, eventdata, handles)
% hObject    handle to admitEq (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --- Executes on button press in checkbox_Pcos.
function checkbox_Pcos_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox_Pcos (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox_Pcos

checkboxPcosStatus = get(handles.checkbox_Pcos,'Value');

if checkboxPcosStatus == 1

    set(handles.Pact,'Enable','on');
    set(handles.cosfii,'Enable','on');

    set(handles.potap_carga,'Enable','off');
    set(handles.checkbox_potap,'Value',0);
    set(handles.potap_carga,'String','');

    set(handles.intens_carga,'Enable','off');
    set(handles.checkbox_intens,'Value',0);
    set(handles.intens_carga,'String','');

    set(handles.indice_carga,'Enable','off');
    set(handles.checkbox_indicecarga,'Value',0);
    set(handles.indice_carga,'String','');

else

    set(handles.Pact,'Enable','off');
    set(handles.Pact,'String','');

end


function Pact_Callback(hObject, eventdata, handles)
% hObject    handle to Pact (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of Pact as text
%        str2double(get(hObject,'String')) returns contents of Pact as a double


% --- Executes during object creation, after setting all properties.
function Pact_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Pact (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function cosfii_Callback(hObject, eventdata, handles)
% hObject    handle to cosfii (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of cosfii as text
%        str2double(get(hObject,'String')) returns contents of cosfii as a double
```

```matlab
% --- Executes during object creation, after setting all properties.
function cosfii_CreateFcn(hObject, eventdata, handles)
% hObject    handle to cosfii (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --- Executes on button press in checkbox_induct.
function checkbox_induct_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox_induct (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox_induct

checkboxinductivaStatus = get(handles.checkbox_induct,'Value');

if checkboxinductivaStatus == 1

    set(handles.checkbox_capacit,'Value',0);

else

    set(handles.checkbox_induct,'Value',0);
end

% --- Executes on button press in checkbox_capacit.
function checkbox_capacit_Callback(hObject, eventdata, handles)
% hObject    handle to checkbox_capacit (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of checkbox_capacit

checkboxcapacitivaStatus = get(handles.checkbox_capacit,'Value');

if checkboxcapacitivaStatus == 1

    set(handles.checkbox_induct,'Value',0);

else

    set(handles.checkbox_cpacit,'Value',0);
end

function tens_2_Callback(hObject, eventdata, handles)
% hObject    handle to tens_2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of tens_2 as text
%        str2double(get(hObject,'String')) returns contents of tens_2 as a double


% --- Executes during object creation, after setting all properties.
function tens_2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to tens_2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function coefvar_u_Callback(hObject, eventdata, handles)
% hObject    handle to coefvar_u (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

```matlab
% Hints: get(hObject,'String') returns contents of coefvar_u as text
%        str2double(get(hObject,'String')) returns contents of coefvar_u as a double


% --- Executes during object creation, after setting all properties.
function coefvar_u_CreateFcn(hObject, eventdata, handles)
% hObject    handle to coefvar_u (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function ferranti_anuncio_Callback(hObject, eventdata, handles)
% hObject    handle to ferranti_anuncio (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of ferranti_anuncio as text
%        str2double(get(hObject,'String')) returns contents of ferranti_anuncio as a double


% --- Executes during object creation, after setting all properties.
function ferranti_anuncio_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ferranti_anuncio (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end

function anuncio_ferranti_Callback(hObject, eventdata, handles)
% hObject    handle to anuncio_ferranti (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of anuncio_ferranti as text
%        str2double(get(hObject,'String')) returns contents of anuncio_ferranti as a double


% --- Executes during object creation, after setting all properties.
function anuncio_ferranti_CreateFcn(hObject, eventdata, handles)
% hObject    handle to anuncio_ferranti (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end

% --------------------------------------------------------------------
function menu_salir_Callback(hObject, eventdata, handles)
% hObject    handle to menu_salir (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

options.Interpreter = 'tex';
options.Default = 'Si';
qstring = '\fontsize{15}\fontname{Calibri} ¿Seguro que desea abandonar el programa?';
selection = questdlg (qstring,'Salir',...
                      'Si','No',options);

 switch selection
     case 'Si'
         if exist ('h0','var')

             delete (ho)
             clear h0
         end
```
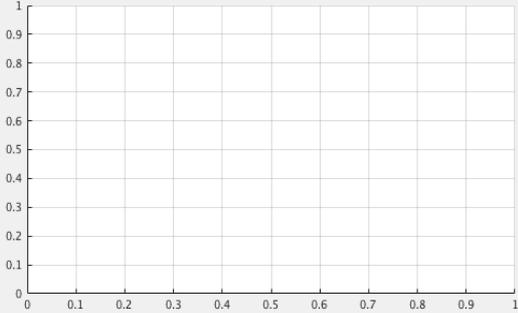
```
        delete (gcbf)
        clear all
        clc

    case 'No'

        return
end
```

Inserte los datos del transformador:

V1N ☐ (kV)   R1 ☐ (Ω)   X1 ☐ (S)

V2N ☐ (kV)   R2 ☐ (Ω)   X2 ☐ (S)

SN ☐ (kVA)

☐ Uso de impedancias equivalentes:

Re ☐ (Ω)   Xe ☐ (S)

Inserte los datos de la carga:

☐ S ☐ (kVA)

☐ I ☐ (A)

☐ i ☐

☐ P ☐ (kW)

cos(φ) ☐   ☐ Inductiva
              ☐ Capacitiva

Variación del angulo φ de Ferranti frente a distintos indices de carga:

Dibujar

Resultado:

Calcular

Angulo de la carga capacitiva para el cual se empieza a producir el Efecto Ferranti:

φ de Ferranti = ☐ °

Tensión en el secundario:

V2 = ☐ (V)

Coeficiente de variación de tensión:

u = ☐ (%)