APPENDIX A – MAIN INTRODUCTION OF CURRENT TRANSFORMER (Introduction .m)

```
################################################################################
```

INTRODUCTION
PROGRAM DESIGNED BY:-
AHMAD NAJMI ABDULLAH (KGD070005)

```
################################################################################

function varargout = MainBD(varargin)
MAINBD M-file for MainBD.fig
%      MAINBD, by itself, creates a new MAINBD or raises the existing
%      singleton*.
%      H = MAINBD returns the handle to a new MAINBD or the handle to
%      the existing singleton*.
%      MAINBD('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in MAINBD.M with the given input
       arguments.
%      MAINBD('Property','Value',...) creates a new MAINBD or raises the
%      existing singleton*.  Starting from the left, property value
       pairs are
%      applied to the GUI before MainBD_OpeningFunction gets called.  An
%      unrecognized property name or invalid value makes property
       application
%      stop.  All inputs are passed to MainBD_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 MainBD

% Last Modified by GUIDE v2.5 09-Aug-2009 20:43:37

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @MainBD_OpeningFcn, ...
                   'gui_OutputFcn',  @MainBD_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 MainBD is made visible.
```

```
function MainBD_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 MainBD (see VARARGIN)

backgroundImage = importdata('blockdiagram.jpg');
axes(handles.blockdiagram_pic);
image(backgroundImage);
axis off

backgroundImage = importdata('TX.jpg');
axes(handles.blockdiagram1_pic);
image(backgroundImage);
axis off

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

% Update handles structure
guidata(hObject, handles);

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

% --- Outputs from this function are returned to the command line.
function varargout = MainBD_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;

% --- Executes on button press in pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
KTF

% --- Executes on button press in pushbutton5.
function pushbutton5_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton5 (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 pushbutton7.
function pushbutton7_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton7 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

APPENDIX B – OVERDIMENSIONING FACTOR-KTF (KTF.m)

****

CODES FOR OVERDIMENSIONING FACTOR – KTF
PROGRAM DISIGNED BY :-
AHMAD NAJMI ABDULLAH (KGD070005)

****

```
function varargout = KTF(varargin)
% KTF M-file for KTF.fig
%      KTF, by itself, creates a new KTF or raises the existing
%      singleton*.
%      H = KTF returns the handle to a new KTF or the handle to
%      the existing singleton*.
%      KTF('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in KTF.M with the given input arguments.
%      KTF('Property','Value',...) creates a new KTF or raises the
%      existing singleton*.  Starting from the left, property value
      pairs are
%      applied to the GUI before KTF_OpeningFunction gets called.  An
%      unrecognized property name or invalid value makes property
      application
%      stop.  All inputs are passed to KTF_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 KTF

% Last Modified by GUIDE v2.5 10-Sep-2009 10:04:58

% Begin initialization code - DO NOT EDIT

gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @KTF_OpeningFcn, ...
                   'gui_OutputFcn',  @KTF_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 KTF is made visible.
function KTF_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 KTF (see VARARGIN)

backgroundImage = importdata('ktf.jpg');
axes(handles.ktf_for);
image(backgroundImage);
axis off

backgroundImage = importdata('angle.jpg');
axes(handles.angle_for);
image(backgroundImage);
axis off

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

% Update handles structure
guidata(hObject, handles);

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

% --- Outputs from this function are returned to the command line.
function varargout = KTF_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;

% --- Executes on button press in pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

a=[0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.01 0.02 0.03
0.04 0.05 0.06 0.07 0.08 0.09 0.1]
b=[1.231 1.011 0.939 0.904 0.882 0.868 0.859 0.851 0.845 0.841 0.820
0.813 0.810 0.808 0.806 0.805 0.805 0.804 0.804]
c=[2.347 1.740 1.533 1.430 1.368 1.328 1.299 1.278 1.261 1.248 1.189
1.169 1.160 1.154 1.150 1.147 1.145 1.144 1.142]
d=[3.556 2.508 2.131 1.940 1.826 1.751 1.697 1.657 1.626 1.602 1.492
1.456 1.438 1.427 1.420 1.415 1.411 1.408 1.406]
e=[4.827 3.318 2.752 2.460 2.284 2.167 2.084 2.021 1.973 1.935 1.765
1.709 1.681 1.665 1.654 1.646 1.640 1.635 1.632]
f=[6.153 4.159 3.397 2.995 2.750 2.586 2.469 2.382 2.314 2.260 2.020
1.941 1.902 1.879 1.864 1.853 1.845 1.838 1.833]
figure
axes('FontSize',13)
```

```
plot(a,b,'-
o','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
text(pi,0,' \leftarrow sin(\pi)','FontSize',18)
hold on
plot(a,c,'-
go','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold on
plot(a,d,'-
ro','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold on
plot(a,e,'-
co','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold on
plot(a,f,'-
mo','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold off
h = legend('2ms','4ms','6ms','8ms','10ms',5);
set(h,'Interpreter','none')
grid on
xlabel('Tn in ms')
ylabel('Degree(tm,Tn)    (el.degree)')
title('Fault inception anglel','fontsize',20,'fontweight','b')

% --- Executes on button press in pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

a=[0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.01 0.02 0.03
0.04 0.05 0.06 0.07 0.08 0.09 0.1]
g=[0.2606 0.3861 0.4476 0.4834 0.5068 0.5233 0.5355 0.5449 0.5524 0.5584
0.5869 0.5968 0.6018 0.6049 0.6069 0.6084 0.6095 0.6104 0.6111]
h=[0.2862 0.5211 0.6719 0.7722 0.8428 0.8950 0.9351 0.9667 0.9924 1.0136
1.1168 1.1543 1.1737 1.1855 1.1935 1.1992 1.2036 1.2070 1.2097]
i=[0.2800 0.5636 0.7815 0.9428 1.0643 1.1581 1.2325 1.2927 1.3424 1.3840
1.5951 1.6750 1.7170 1.7428 1.7604 1.7730 1.7826 1.7901 1.7961]
j=[0.2693 0.5721 0.8322 1.0418 1.2089 1.3433 1.4530 1.5439 1.6203 1.6852
2.0267 2.1613 2.2331 2.2777 2.3081 2.3302 2.3469 2.3600 2.3706]
k=[0.2580 0.5679 0.8526 1.0973 1.3020 1.4727 1.6159 1.7370 1.8404 1.9296
2.4160 2.6154 2.7234 2.7911 2.8375 2.8713 2.8969 2.9171 2.9334]

figure
axes('FontSize',13)
plot(a,g,'-
o','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold on
plot(a,h,'-
go','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold on
```

```
plot(a,i,'-
ro','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold on
plot(a,j,'-
co','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold on
plot(a,k,'-
mo','LineWidth',0.5,'MarkerEdgeColor','r','MarkerFaceColor',[.49 1
.63],'MarkerSize',3)
hold off
h = legend('2ms','4ms','6ms','8ms','10ms',5);
set(h,'Interpreter','none')
grid on
xlabel('Tn in ms')
ylabel('Ktf')
title('Transient Over-Dimensioning factor
KTF','fontsize',20,'fontweight','b')

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

APPENDIX C – CORE 1 –TRANSFORMER BIASSED DIFFERENTIAL PROTECTION (MainCore.m)

****

CODES FOR CORE 1- TRANSFORMER BIASSED DIFFERENTIAL PROTECTION
PROGRAM DISIGNED BY :-
AHMAD NAJMI ABDULLAH (KGD070005)

****

```
function varargout = MainCore(varargin)
% MAINCORE M-file for MainCore.fig
%      MAINCORE, by itself, creates a new MAINCORE or raises the
      existing
%      singleton*.
%      H = MAINCORE returns the handle to a new MAINCORE or the handle
      to
%      the existing singleton*.
%      MAINCORE('CALLBACK',hObject,eventData,handles,...) calls the
      local
%      function named CALLBACK in MAINCORE.M with the given input
      arguments.
%      MAINCORE('Property','Value',...) creates a new MAINCORE or raises
      the
%      existing singleton*.  Starting from the left, property value
      pairs are
%      applied to the GUI before MainCore_OpeningFunction gets called.
      An
%      unrecognized property name or invalid value makes property
      application
%      stop.  All inputs are passed to MainCore_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 MainCore

% Last Modified by GUIDE v2.5 12-Nov-2009 15:23:47

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @MainCore_OpeningFcn, ...
                   'gui_OutputFcn',  @MainCore_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 MainCore is made visible.
function MainCore_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 MainCore (see VARARGIN)

backgroundImage = importdata('kbch130.jpg');
axes(handles.kbch_pic);
image(backgroundImage);
axis off

backgroundImage = importdata('CT1.jpg');
axes(handles.CT_pic);
image(backgroundImage);
axis off

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

% Update handles structure
guidata(hObject, handles);

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

% --- Outputs from this function are returned to the command line.
function varargout = MainCore_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;

% --- Executes on button press in togglebutton1.
function togglebutton1_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton1 (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 togglebutton1

% --- Executes on button press in togglebutton2.
function togglebutton2_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton2 (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 togglebutton2
```

```
function Ip2_Callback(hObject, eventdata, handles)
% hObject    handle to Ip2 (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 Ip2 as text
%        str2double(get(hObject,'String')) returns contents of Ip2 as a
double

handles.Ip2=str2double(get(hObject,'string'));
if isnan(handles.Ip2)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip2 (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 Ip3_Callback(hObject, eventdata, handles)
% hObject    handle to Ip3 (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 Ip3 as text
%        str2double(get(hObject,'String')) returns contents of Ip3 as a
double

handles.Ip3=str2double(get(hObject,'string'));
if isnan(handles.Ip3)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip3_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip3 (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 togglebutton3.
function togglebutton3_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton3 (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 togglebutton3

% --- Executes on button press in togglebutton4.
function togglebutton4_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton4 (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 togglebutton4

% --- Executes on button press in togglebutton5.
function togglebutton5_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton5 (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 togglebutton5

% --- Executes on button press in Rct1.
function Rct1_Callback(hObject, eventdata, handles)
% hObject    handle to Rct1 (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 Rct1

function Rr_Callback(hObject, eventdata, handles)
% hObject    handle to Rr (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 Rr as text
%        str2double(get(hObject,'String')) returns contents of Rr as a
double

handles.Rr=str2double(get(hObject,'string'));
if isnan(handles.Rr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)
% --- Executes during object creation, after setting all properties.
function Rr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Rr (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 VA1_Callback(hObject, eventdata, handles)
% hObject    handle to VA1 (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 VA1 as text
%        str2double(get(hObject,'String')) returns contents of VA1 as a
double

handles.VA1=str2double(get(hObject,'string'));
if isnan(handles.VA1)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function VA1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to VA1 (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 pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% To calculate highest CT Secondary resistance
Rct1=(handles.Ip1)*(handles.Ohm);
set(handles.Rct1,'string',Rct1);

% To calculate Knee point Voltage
RL=2*(handles.Ic)*(handles.Cr);
Vknee=handles.ALF*(handles.VA1+Rct1);
set(handles.Vknee,'string',Vknee);
% To calculate the Actual Connected resistance
Rb=RL+(handles.Rr);
set(handles.Rb,'string',Rb);

% To calculate Acccurate Burden
VA=(Vknee/(handles.ALF))-Rct1;
set(handles.VA,'string',VA);

% --- Executes on button press in pushbutton2.
```

```
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

function Vs_Callback(hObject, eventdata, handles)
% hObject    handle to Vs (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 Vs as text
%        str2double(get(hObject,'String')) returns contents of Vs as a
double

handles.Vs=str2double(get(hObject,'string'));
if isnan(handles.Vs)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Vs_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Vs (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 togglebutton7.
function togglebutton7_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton7 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% To calculate the Dc times constant of the applicable fault loop
T1=((handles.Xr)/(2*pi*(handles.f)));
set(handles.T1,'string',T1);

% To calculate the Source impedance
Zs=handles.Vs*1000/(sqrt(3)*handles.If*1000);
set(handles.Zs,'string',Zs);

% To calculate the Real part of Source impedance
Rs=(1.1)*(Zs)*((cos((83.08*pi)/180)));
set(handles.Rs,'string',Rs);

% To calculate the imag part of Source impedance
Xs=(1.1)*(Zs)*((sin((83.08*pi)/180)));
set(handles.Xs,'string',Xs);

% To Calculate the Actual Source impedance
```

```
Zbs=sqrt(Rs^2+Xs^2);
set(handles.Zbs,'string',Zbs);

% To Calculate the real part of Line Impedance
Rl=(0.2887)*(0.8)*(handles.L)*(cos((83.08*pi)/180));
set(handles.Rl,'string',Rl);

% To Calculate the imag part of Line Impedance
Xl=(0.2887)*(0.8)*(handles.L)*(sin((83.08*pi)/180));
set(handles.Xl,'string',Xl);

% To calculate the Actual Line Impedance
Zbl=sqrt(Rl^2+Xl^2);
set(handles.Zbl,'string',Zbl);

% To calculate the Lead resistance
RL=2*(handles.Ic)*(handles.Cr);
set(handles.RL,'string',RL);

% To calculate the overall Total impedance
ZT=sqrt(((Rs+Rl)^2)+((Xs+Xl)^2));
set(handles.ZT,'string',ZT);

% To calculate the transient overdimensioning factor
Ktf=0.75;
set(handles.Ktf,'string',Ktf);

% To calculate the transient overdimensioning that consider remanence
Krem=1/((1-handles.Kr));
set(handles.Krem,'string',Krem);

% to calculate full load current in primary
Ip=(handles.MVA*1000000)/(handles.Vs*1000*sqrt(3));
set(handles.Ip,'string',Ip);

% Hint: get(hObject,'Value') returns toggle state of togglebutton7

% --- Executes on button press in pushbutton3.
function pushbutton3_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

Ktf=0.75;
Zs=handles.Vs*1000/(sqrt(3)*handles.If*1000);
If1=(1.1*(handles.Vs*1000/sqrt(3)))/Zs;
ALF10=(If1/(handles.Ip1))*Ktf;
set(handles.ALF10,'string',ALF10);

RL=2*(handles.Ic)*(handles.Cr);
Rct1=(handles.Ip1)*(handles.Ohm);
Rb=RL+(handles.Rr);

% To calculate Actual Accuracy Limit factor
Pi=(handles.Ip3)*Rct1;
Pn=handles.VA1;
```

```
Pb=(handles.Ip3)*(RL+(handles.Rr));
ALF2=(ALF10)*((Pi+Pb)/(Pi+Pn));
set(handles.ALF2,'string',ALF2);

% To calculate Actual knee point Voltage
Vknee1=(ALF2)*(handles.Ip3)*(Rct1+Rb);
set(handles.Vknee1,'string',Vknee1);

% To calculate Actual Burden
VA2=(Vknee1/ALF2)-Rct1;
set(handles.VA2,'string',VA2);

%Compare the Accuracy Limit Factor
i=1;
if ALF2<=handles.ALF20 && Vknee1<=handles.Vknee20 && VA2<=handles.VA20
e{i}=sprintf('CT is Adequate\n');
else
e{i}=sprintf('CT is not Adequate\n');
end
handles.list=[e];
set(handles.status,'string',handles.list);
guidata(hObject, handles);

% --- Executes on button press in pushbutton4.
function pushbutton4_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
core1;

% --- Executes on button press in Rb.
function Rb_Callback(hObject, eventdata, handles)
% hObject    handle to Rb (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 Rb

% --- Executes on button press in togglebutton9.
function togglebutton9_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton9 (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 togglebutton9

% --- Executes on button press in togglebutton10.
function togglebutton10_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton10 (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 togglebutton10

% --- Executes on button press in Ip.
function Ip_Callback(hObject, eventdata, handles)
% hObject    handle to Ip (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 Ip

% --- Executes on button press in togglebutton12.
function togglebutton12_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton12 (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 togglebutton12

% --- Executes on button press in togglebutton13.
function togglebutton13_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton13 (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 togglebutton13

% --- Executes on button press in togglebutton14.
function togglebutton14_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton14 (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 togglebutton14

function If_Callback(hObject, eventdata, handles)
% hObject    handle to If (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 If as text
%        str2double(get(hObject,'String')) returns contents of If as a
double
handles.If=str2double(get(hObject,'string'));
if isnan(handles.If)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function If_CreateFcn(hObject, eventdata, handles)
% hObject    handle to If (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 togglebutton15.
function togglebutton15_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton15 (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 togglebutton15

function f_Callback(hObject, eventdata, handles)
% hObject    handle to f (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 f as text
%        str2double(get(hObject,'String')) returns contents of f as a
double

handles.f=str2double(get(hObject,'string'));
if isnan(handles.f)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function f_CreateFcn(hObject, eventdata, handles)
% hObject    handle to f (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 Xr_Callback(hObject, eventdata, handles)
% hObject    handle to Xr (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 Xr as text
%        str2double(get(hObject,'String')) returns contents of Xr as a
double

handles.Xr=str2double(get(hObject,'string'));
if isnan(handles.Xr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Xr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Xr (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 togglebutton16.
function togglebutton16_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton16 (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 togglebutton16

function Ic_Callback(hObject, eventdata, handles)
% hObject    handle to Ic (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 Ic as text
%        str2double(get(hObject,'String')) returns contents of Ic as a
double

handles.Ic=str2double(get(hObject,'string'));
if isnan(handles.Ic)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ic_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ic (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 togglebutton17.
function togglebutton17_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton17 (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 togglebutton17

function Cc_Callback(hObject, eventdata, handles)
% hObject    handle to Cc (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 Cc as text
%        str2double(get(hObject,'String')) returns contents of Cc as a
double

handles.Cc=str2double(get(hObject,'string'));
if isnan(handles.Cc)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Cc_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Cc (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 togglebutton18.
function togglebutton18_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton18 (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 togglebutton18
function Cr_Callback(hObject, eventdata, handles)
% hObject    handle to Cr (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 Cr as text
%        str2double(get(hObject,'String')) returns contents of Cr as a
double

handles.Cr=str2double(get(hObject,'string'));
if isnan(handles.Cr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Cr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Cr (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 togglebutton19.
function togglebutton19_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton19 (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 togglebutton19

function L_Callback(hObject, eventdata, handles)
% hObject    handle to L (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 L as text
%        str2double(get(hObject,'String')) returns contents of L as a
double

handles.L=str2double(get(hObject,'string'));
if isnan(handles.L)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function L_CreateFcn(hObject, eventdata, handles)
% hObject    handle to L (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 togglebutton20.
function togglebutton20_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton20 (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 togglebutton20

function ohm_Callback(hObject, eventdata, handles)
% hObject    handle to ohm (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 ohm as text
```

```
%        str2double(get(hObject,'String')) returns contents of ohm as a
double

handles.Ohm=str2double(get(hObject,'string'));
if isnan(handles.Ohm)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function ohm_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ohm (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 togglebutton21.
function togglebutton21_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton21 (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 togglebutton21
function Kr_Callback(hObject, eventdata, handles)
% hObject    handle to Kr (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 Kr as text
%        str2double(get(hObject,'String')) returns contents of Kr as a
double

handles.Kr=str2double(get(hObject,'string'));
if isnan(handles.Kr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Kr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Kr (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 togglebutton22.
function togglebutton22_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton22 (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 togglebutton22

function ALF_Callback(hObject, eventdata, handles)
% hObject    handle to ALF (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 ALF as text
%        str2double(get(hObject,'String')) returns contents of ALF as a
double

handles.ALF=str2double(get(hObject,'string'));
if isnan(handles.ALF)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function ALF_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ALF (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 pushbutton5.
function pushbutton5_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton5 (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 Zs.
function Zs_Callback(hObject, eventdata, handles)
% hObject    handle to Zs (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 Zs

% --- Executes on button press in pushbutton6.
function pushbutton6_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton6 (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 Zbs.
function Zbs_Callback(hObject, eventdata, handles)
% hObject    handle to Zbs (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 Zbs

% --- Executes on button press in pushbutton7.
function pushbutton7_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton7 (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 Rs.
function Rs_Callback(hObject, eventdata, handles)
% hObject    handle to Rs (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 Rs

% --- Executes on button press in pushbutton8.
function pushbutton8_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton8 (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 Xs.
function Xs_Callback(hObject, eventdata, handles)
% hObject    handle to Xs (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 Xs

% --- Executes on button press in pushbutton9.
function pushbutton9_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton9 (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 T1.
function T1_Callback(hObject, eventdata, handles)
% hObject    handle to T1 (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 T1

% --- Executes on button press in pushbutton10.
function pushbutton10_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton10 (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 Zbl.
function Zbl_Callback(hObject, eventdata, handles)
% hObject    handle to Zbl (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 Zbl

% --- Executes on button press in pushbutton11.
function pushbutton11_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton11 (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 Rl.
function Rl_Callback(hObject, eventdata, handles)
% hObject    handle to Rl (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 Rl
% --- Executes on button press in pushbutton12.
function pushbutton12_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton12 (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 Xl.
function Xl_Callback(hObject, eventdata, handles)
% hObject    handle to Xl (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 Xl

% --- Executes on button press in pushbutton13.
function pushbutton13_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton13 (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 togglebutton31.
function togglebutton31_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton31 (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 togglebutton31

% --- Executes on button press in pushbutton14.
function pushbutton14_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton14 (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 ZT.
function ZT_Callback(hObject, eventdata, handles)
% hObject    handle to ZT (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 ZT

% --- Executes on button press in pushbutton15.
function pushbutton15_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton15 (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 Ktf.
function Ktf_Callback(hObject, eventdata, handles)
% hObject    handle to Ktf (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 Ktf
% --- Executes on button press in pushbutton16.
function pushbutton16_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton16 (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 Krem.
function Krem_Callback(hObject, eventdata, handles)
% hObject    handle to Krem (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 Krem

% --- Executes on button press in pushbutton17.
function pushbutton17_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton17 (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 Rct2.
function Rct2_Callback(hObject, eventdata, handles)
% hObject    handle to Rct2 (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 Rct2

% --- Executes on button press in togglebutton36.
function togglebutton36_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton36 (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 togglebutton36

% --- Executes on button press in togglebutton37.
function togglebutton37_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton37 (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 togglebutton37

% --- Executes on button press in togglebutton38.
function togglebutton38_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton38 (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 togglebutton38

function Ip1_Callback(hObject, eventdata, handles)
% hObject    handle to Ip1 (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 Ip1 as text
%        str2double(get(hObject,'String')) returns contents of Ip1 as a
double

handles.Ip1=str2double(get(hObject,'string'));
if isnan(handles.Ip1)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip1 (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 togglebutton39.
function togglebutton39_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton39 (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 togglebutton39

% --- Executes on button press in togglebutton40.
function togglebutton40_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton40 (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 togglebutton40

% --- Executes on button press in togglebutton41.
function togglebutton41_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton41 (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 togglebutton41

% --- Executes on button press in togglebutton42.
function togglebutton42_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton42 (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 togglebutton42

% --- Executes on button press in RL.
function RL_Callback(hObject, eventdata, handles)
% hObject    handle to RL (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 RL

% --- Executes on button press in togglebutton43.
function togglebutton43_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton43 (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 togglebutton43

function Io_Callback(hObject, eventdata, handles)
% hObject    handle to Io (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 Io as text
%        str2double(get(hObject,'String')) returns contents of Io as a
double

handles.Io=str2double(get(hObject,'string'));
if isnan(handles.Io)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Io_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Io (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 pushbutton18.
function pushbutton18_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton18 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
function MVA_Callback(hObject, eventdata, handles)
% hObject    handle to MVA (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 MVA as text
%        str2double(get(hObject,'String')) returns contents of MVA as a
double

handles.MVA=str2double(get(hObject,'string'));
if isnan(handles.MVA)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function MVA_CreateFcn(hObject, eventdata, handles)
% hObject    handle to MVA (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 togglebutton44.
function togglebutton44_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton44 (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 togglebutton44

% --- Executes on button press in togglebutton45.
function togglebutton45_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton45 (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 togglebutton45

% --- Executes on button press in togglebutton46.
function togglebutton46_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton46 (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 togglebutton46

% --- Executes on button press in togglebutton47.
function togglebutton47_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton47 (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 togglebutton47

% --- Executes on button press in togglebutton48.
function togglebutton48_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton48 (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 togglebutton48

% --- Executes on button press in togglebutton49.
function togglebutton49_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton49 (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 togglebutton49

% --- Executes on button press in togglebutton50.
function togglebutton50_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton50 (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 togglebutton50

% --- Executes on button press in togglebutton52.
function togglebutton52_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton52 (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 togglebutton52

% --- Executes on button press in togglebutton53.
function togglebutton53_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton53 (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 togglebutton53

% --- Executes on button press in togglebutton55.
function togglebutton55_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton55 (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 togglebutton55

% --- Executes on button press in ALF20.
function ALF20_Callback(hObject, eventdata, handles)
% hObject    handle to ALF20 (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 ALF20
handles.ALF20=str2double(get(hObject,'string'));
if isnan(handles.ALF20)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes on button press in Vknee20.
function Vknee20_Callback(hObject, eventdata, handles)
% hObject    handle to Vknee20 (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 Vknee20

handles.Vknee20=str2double(get(hObject,'string'));
if isnan(handles.Vknee20)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes on button press in togglebutton58.
function togglebutton58_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton58 (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 togglebutton58

% --- Executes on button press in VA20.
function VA20_Callback(hObject, eventdata, handles)
% hObject    handle to VA20 (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 VA20

handles.VA20=str2double(get(hObject,'string'));
if isnan(handles.VA20)
    errordlg('you must enter a numeric value','Error')
```

```
end
guidata(hObject,handles)

% --- Executes on button press in togglebutton60.
function togglebutton60_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton60 (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 togglebutton60
% --- Executes on button press in togglebutton61.
function togglebutton61_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton61 (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 togglebutton61

% --- Executes on button press in togglebutton62.
function togglebutton62_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton62 (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 togglebutton62

% --- Executes on button press in togglebutton63.
function togglebutton63_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton63 (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 togglebutton63

% --- Executes on button press in togglebutton64.
function togglebutton64_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton64 (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 togglebutton64

% --- Executes on button press in togglebutton65.
function togglebutton65_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton65 (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 togglebutton65

% --- Executes on button press in togglebutton66.
function togglebutton66_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton66 (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 togglebutton66
```

```
% --- Executes on button press in togglebutton67.
function togglebutton67_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton67 (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 togglebutton67

% --- Executes on button press in togglebutton68.
function togglebutton68_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton68 (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 togglebutton68
function status_Callback(hObject, eventdata, handles)
% hObject    handle to status (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 status as text
%        str2double(get(hObject,'String')) returns contents of status as
a double

% --- Executes during object creation, after setting all properties.
function status_CreateFcn(hObject, eventdata, handles)
% hObject    handle to status (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 Ohm_Callback(hObject, eventdata, handles)
% hObject    handle to Ohm (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 Ohm as text
%        str2double(get(hObject,'String')) returns contents of Ohm as a
double
handles.Ohm=str2double(get(hObject,'string'));
if isnan(handles.Ohm)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ohm_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ohm (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 during object creation, after setting all properties.
function ALF20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ALF20 (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 during object creation, after setting all properties.
function Vknee20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Vknee20 (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 during object creation, after setting all properties.
function VA20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to VA20 (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 togglebutton69.
function togglebutton69_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton69 (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 togglebutton69
```

```
function edit25_Callback(hObject, eventdata, handles)
% hObject    handle to VA20 (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 VA20 as text
%        str2double(get(hObject,'String')) returns contents of VA20 as a
double

% --- Executes during object creation, after setting all properties.
function edit25_CreateFcn(hObject, eventdata, handles)
% hObject    handle to VA20 (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 togglebutton71.
function togglebutton71_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton71 (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 togglebutton71

% --- Executes on button press in togglebutton72.
function togglebutton72_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton72 (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 togglebutton72

% --- Executes on button press in togglebutton73.
function togglebutton73_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton73 (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 togglebutton73

% --- Executes on button press in togglebutton74.
function togglebutton74_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton74 (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 togglebutton74
% --- Executes on button press in togglebutton75.
function togglebutton75_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton75 (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 togglebutton75
% --- Executes on button press in togglebutton76.
function togglebutton76_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton76 (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 togglebutton76

% --- Executes on button press in togglebutton77.
function togglebutton77_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton77 (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 togglebutton77

% --- Executes on button press in togglebutton78.
function togglebutton78_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton78 (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 togglebutton78

% --- Executes on button press in togglebutton79.
function togglebutton79_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton79 (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 togglebutton79

% --- Executes on button press in togglebutton80.
function togglebutton80_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton80 (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 togglebutton80

% --- Executes on button press in togglebutton81.
function togglebutton81_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton81 (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 togglebutton81
% --- Executes on button press in togglebutton82.
function togglebutton82_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton82 (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 togglebutton82
% --- Executes on button press in togglebutton83.
function togglebutton83_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton83 (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 togglebutton83

% --- Executes on button press in togglebutton84.
function togglebutton84_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton84 (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 togglebutton84

% --- Executes on button press in togglebutton85.
function togglebutton85_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton85 (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 togglebutton85

% --- Executes on button press in togglebutton86.
function togglebutton86_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton86 (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 togglebutton86

% --- Executes on button press in togglebutton87.
function togglebutton87_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton87 (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 togglebutton87

% --- Executes on button press in togglebutton88.
function togglebutton88_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton88 (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 togglebutton88

% --- Executes on button press in togglebutton89.
function togglebutton89_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton89 (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 togglebutton89

% --- Executes on button press in togglebutton90.
function togglebutton90_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton90 (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 togglebutton90

% --- Executes on button press in togglebutton91.
function togglebutton91_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton91 (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 togglebutton91

% --- Executes on button press in togglebutton92.
function togglebutton92_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton92 (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 togglebutton92
% --- Executes on button press in togglebutton93.
function togglebutton93_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton93 (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 togglebutton93

% --- Executes on button press in togglebutton94.
function togglebutton94_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton94 (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 togglebutton94

% --- Executes on button press in togglebutton95.
function togglebutton95_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton95 (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 togglebutton95

% --- Executes on button press in togglebutton96.
function togglebutton96_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton96 (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 togglebutton96
```

```
% --- Executes on button press in togglebutton97.
function togglebutton97_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton97 (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 togglebutton97

% --- Executes on button press in togglebutton98.
function togglebutton98_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton98 (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 togglebutton98

% --- Executes on button press in togglebutton99.
function togglebutton99_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton99 (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 togglebutton99

% --- Executes on button press in pushbutton23.
function pushbutton23_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton23 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)


x1=[0.0010 0.0020 0.0040 0.0050 0.0080 0.0100 0.0200 0.0400 0.0500
0.0800 0.1000 0.2000 0.4000 0.5000 0.8000 1.000]
y1=[1.6 3.8 10.6 16.0 29.4 40.0 110.4 308.4 375.2 444.2 459.6 491.3
511.6 517.8 530.1 536.0]
y2=[2.2 4.0 13.2 17.2 33.0 45.0 118.1 316.4 387.6 464.8 480.8 510.3
529.3 534.8 546.2 552.1]
y3=[2.1 4.1 13.5 19.8 36.9 49.8 134.6 357.5 423.1 482.4 494.9 519.0
536.4 541.2 552.6 558.7]

figure
axes('FontSize',13)
loglog(x1,y1,'-
ro','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','g','MarkerS
ize',2)
hold on
loglog(x1,y2,'-
yo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','r','MarkerS
ize',2)
hold on
loglog(x1,y3,'-
bo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','w','MarkerS
ize',2)
hold off
h = legend('Red Phase','Yellow Phase','Blue Phase',10);
grid on
xlabel({'Current in mA';'Current'})
```

```
ylabel({'Voltage in V';'Voltage'})
title('CT SATURATION PLOT','fontsize',15,'fontweight','b');
text(0.0580,350.1,'(0.0580,408.1)','FontSize',10,'fontweight','b')
text(0.0700,400.1,'(0.0592,427.4)','FontSize',10,'fontweight','b')
text(0.0700,500.1,'(0.0524,4432.7)','FontSize',10,'fontweight','b')
text(0.01,14,'ASA 10/50Vkp:CT R = 408.1 V; CT Y = 427.4V: CT B =
432.7V','FontSize',12,'fontweight','b')
text(0.01,11,'Vkp = 204.05
V;213.7V;216.35V','FontSize',12,'fontweight','b')
```

APPENDIX D – CORE 2 –TRANSFORMER HIGH IMPEDANCE PROTECTION (Core1.m)

****

CODES FOR CORE 2 – TRANSFORMER HIGH IMPEDANCE PROTECTION
PROGRAM DISIGNED BY :-
AHMAD NAJMI ABDULLAH (KGD070005)

****

```
function varargout = core1(varargin)
% CORE1 M-file for core1.fig
%      CORE1, by itself, creates a new CORE1 or raises the existing
%      singleton*.
%      H = CORE1 returns the handle to a new CORE1 or the handle to
%      the existing singleton*.
%      CORE1('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in CORE1.M with the given input
      arguments.
%      CORE1('Property','Value',...) creates a new CORE1 or raises the
%      existing singleton*.  Starting from the left, property value
      pairs are
%      applied to the GUI before core1_OpeningFunction gets called.  An
%      unrecognized property name or invalid value makes property
      application
%      stop.  All inputs are passed to core1_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 core1

% Last Modified by GUIDE v2.5 12-Nov-2009 15:30:07

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @core1_OpeningFcn, ...
                   'gui_OutputFcn',  @core1_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 core1 is1 made visible.
function core1_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 core1 (see VARARGIN)
backgroundImage = importdata('mcag34.jpg');
axes(handles.mcag34_pic);
image(backgroundImage);
axis off

%backgroundImage = importdata('kbch130.jpg');
%axes(handles.Kbch130_pic);
%image(backgroundImage);
%axis off

% Choose default command line output for core1
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes core1 wait for user response (see UIRESUME)
% uiwait(handles.figure1);

% --- Outputs from this function are returned to the command line.
function varargout = core1_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 edit1_Callback(hObject, eventdata, handles)
% hObject    handle to edit1 (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 edit1 as text
%        str2double(get(hObject,'String')) returns contents of edit1 as
a double

% --- Executes during object creation, after setting all properties.
function edit1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit1 (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 Ip1_Callback(hObject, eventdata, handles)
% hObject    handle to Ip1 (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 Ip1 as text
%        str2double(get(hObject,'String')) returns contents of Ip1 as a
double

handles.Ip1=str2double(get(hObject,'string'));
if isnan(handles.Ip1)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip1 (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 Ip2_Callback(hObject, eventdata, handles)
% hObject    handle to Ip2 (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 Ip2 as text
%        str2double(get(hObject,'String')) returns contents of Ip2 as a
double

handles.Ip2=str2double(get(hObject,'string'));
if isnan(handles.Ip2)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip2 (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 Ip3_Callback(hObject, eventdata, handles)
% hObject    handle to Ip3 (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 Ip3 as text
%        str2double(get(hObject,'String')) returns contents of Ip3 as a
double

handles.Ip3=str2double(get(hObject,'string'));
if isnan(handles.Ip3)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip3_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip3 (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 Io_Callback(hObject, eventdata, handles)
% hObject    handle to Io (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 Io as text
%        str2double(get(hObject,'String')) returns contents of Io as a
double

handles.Io=str2double(get(hObject,'string'));
if isnan(handles.Io)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Io_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Io (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 Rr_Callback(hObject, eventdata, handles)
% hObject    handle to Rr (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 Rr as text
%        str2double(get(hObject,'String')) returns contents of Rr as a
double

handles.Rr=str2double(get(hObject,'string'));
if isnan(handles.Rr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Rr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Rr (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 VA1_Callback(hObject, eventdata, handles)
% hObject    handle to VA1 (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 VA1 as text
%        str2double(get(hObject,'String')) returns contents of VA1 as a
double

handles.VA1=str2double(get(hObject,'string'));
if isnan(handles.VA1)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function VA1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to VA1 (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 pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% To calculate highest CT Secondary resistance
Rct1=(handles.Ip1)*(handles.Ohm)
set(handles.Rct1,'string',Rct1);

% To calculate Lowest CT Secondary resistance
Rct2=(handles.Ip2)*(handles.Ohm);
set(handles.Rct2,'string',Rct2);

% to calculate full load current in secondary
Ip=(handles.MVA*1000000)/((handles.Vs*1000)*sqrt(3));
Is1=Ip/(handles.Ip1);
set(handles.Is1,'string',Is1);

% to calculate full load current in secondary
Is2=Ip/(handles.Ip2);
set(handles.Is2,'string',Is2);

% to calculate the Ext.Fault Current for 1st ratio
Iefc1=16*Is1;
set(handles.Iefc1,'string',Iefc1);

% to calculate the Ext.Fault Current for 2nd ratio
Iefc2=16*Is2;
set(handles.Iefc2,'string',Iefc2);

% To calculate Knee point Voltage
RL=2*(handles.Ic)*(handles.Cr);
Vknee=(3)*(Iefc1)*(Rct1+RL);
set(handles.Vknee,'string',Vknee);

% To calculate 2nd ratio Knee point Voltage
Vknee2=(3)*(Iefc2)*(Rct2+RL);
set(handles.Vknee2,'string',Vknee2);
% To calculate the Actual Connected resistance
Rb=RL+(handles.Rr);
set(handles.Rb,'string',Rb);
% To calculate Acccurate Burden
VA=(Vknee/handles.ALF)-Rct1;
set(handles.VA,'string',VA);

% To calculate 2nd ratio Acccurate Burden
VA3=(Vknee2/handles.ALF)-Rct2;
set(handles.VA3,'string',VA3);
```

```
function Vs_Callback(hObject, eventdata, handles)
% hObject    handle to Vs (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 Vs as text
%        str2double(get(hObject,'String')) returns contents of Vs as a
double

handles.Vs=str2double(get(hObject,'string'));
if isnan(handles.Vs)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Vs_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Vs (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 If_Callback(hObject, eventdata, handles)
% hObject    handle to If (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 If as text
%        str2double(get(hObject,'String')) returns contents of If as a
double

handles.If=str2double(get(hObject,'string'));
if isnan(handles.If)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)
% --- Executes during object creation, after setting all properties.
function If_CreateFcn(hObject, eventdata, handles)
% hObject    handle to If (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 f_Callback(hObject, eventdata, handles)
% hObject    handle to f (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 f as text
%        str2double(get(hObject,'String')) returns contents of f as a
double

handles.f=str2double(get(hObject,'string'));
if isnan(handles.f)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function f_CreateFcn(hObject, eventdata, handles)
% hObject    handle to f (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 Ic_Callback(hObject, eventdata, handles)
% hObject    handle to Ic (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 Ic as text
%        str2double(get(hObject,'String')) returns contents of Ic as a
double

handles.Ic=str2double(get(hObject,'string'));
if isnan(handles.Ic)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ic_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ic (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 Cc_Callback(hObject, eventdata, handles)
% hObject    handle to Cc (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 Cc as text
%        str2double(get(hObject,'String')) returns contents of Cc as a
double

handles.Cc=str2double(get(hObject,'string'));
if isnan(handles.Cc)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Cc_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Cc (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 Cr_Callback(hObject, eventdata, handles)
% hObject    handle to Cr (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 Cr as text
%        str2double(get(hObject,'String')) returns contents of Cr as a
double

handles.Cr=str2double(get(hObject,'string'));
if isnan(handles.Cr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Cr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Cr (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 Xr_Callback(hObject, eventdata, handles)
% hObject    handle to Xr (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 Xr as text
%        str2double(get(hObject,'String')) returns contents of Xr as a
double

handles.Xr=str2double(get(hObject,'string'));
if isnan(handles.Xr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Xr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Xr (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 L_Callback(hObject, eventdata, handles)
% hObject    handle to L (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 L as text
%        str2double(get(hObject,'String')) returns contents of L as a
double

handles.L=str2double(get(hObject,'string'));
if isnan(handles.L)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function L_CreateFcn(hObject, eventdata, handles)
% hObject    handle to L (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 Ohm_Callback(hObject, eventdata, handles)
% hObject    handle to Ohm (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 Ohm as text
%        str2double(get(hObject,'String')) returns contents of Ohm as a
double

handles.Ohm=str2double(get(hObject,'string'));
if isnan(handles.Ohm)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ohm_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ohm (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 Kr_Callback(hObject, eventdata, handles)
% hObject    handle to Kr (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 Kr as text
%        str2double(get(hObject,'String')) returns contents of Kr as a
double

handles.Kr=str2double(get(hObject,'string'));
if isnan(handles.Kr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Kr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Kr (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 ALF_Callback(hObject, eventdata, handles)
% hObject    handle to ALF (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 ALF as text
%        str2double(get(hObject,'String')) returns contents of ALF as a
double

handles.ALF=str2double(get(hObject,'string'));
if isnan(handles.ALF)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function ALF_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ALF (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 pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% To calculate the Dc times constant of the applicable fault loop
T1=((handles.Xr)/(2*pi*(handles.f)));
set(handles.T1,'string',T1);

% To calculate the Source impedance
Zs=handles.Vs*1000/(sqrt(3)*handles.If*1000);
set(handles.Zs,'string',Zs);

% To calculate the Real part of Source impedance
Rs=(1.1)*(Zs)*((cos((83.08*pi)/180)))
set(handles.Rs,'string',Rs);

% To calculate the imag part of Source impedance
Xs=(1.1)*(Zs)*((sin((83.08*pi)/180)))
set(handles.Xs,'string',Xs);

% To Calculate the Actual Source impedance
```

```
Zbs=sqrt(Rs^2+Xs^2);
set(handles.Zbs,'string',Zbs);

% To Calculate the real part of Line Impedance
Rl=(0.2887)*(0.8)*(handles.L)*(cos((83.08*pi)/180))
set(handles.Rl,'string',Rl);

% To Calculate the imag part of Line Impedance
Xl=(0.2887)*(0.8)*(handles.L)*(sin((83.08*pi)/180))
set(handles.Xl,'string',Xl);

% To calculate the Actual Line Impedance
Zbl=sqrt(Rl^2+Xl^2);
set(handles.Zbl,'string',Zbl);

% To calculate the Lead resistance
RL=2*(handles.Ic)*(handles.Cr)
set(handles.RL,'string',RL);

% To calculate the overall Total impedance
ZT=sqrt(((Rs+Rl)^2)+((Xs+Xl)^2))
set(handles.ZT,'string',ZT);

% To calculate the transient overdimensioning factor
Ktf=0.75
set(handles.Ktf,'string',Ktf);

% To calculate the transient overdimensioning that consider remanence
Krem=1/((1-handles.Kr))
set(handles.Krem,'string',Krem);

% to calculate full load current in primary
Ip=(handles.MVA*1000000)/(handles.Vs*1000*sqrt(3));
set(handles.Ip,'string',Ip);
% --- Executes on button press in pushbutton3.
function pushbutton3_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton3 (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 pushbutton4.
function pushbutton4_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

Ktf=0.75
Zs=handles.Vs*1000/(sqrt(3)*handles.If*1000);
If1=(1.1*(handles.Vs*1000/sqrt(3)))/Zs

ALF1=(If1/(handles.Ip1))*Ktf
set(handles.ALF1,'string',ALF1);

RL=2*(handles.Ic)*(handles.Cr)
Rct1=(handles.Ip1)*(handles.Ohm)
Rct2=(handles.Ip2)*(handles.Ohm)
```

```
Rb=RL+(handles.Rr)

% To calculate Actual Accuracy Limit factor
Pi=(handles.Ip3)*Rct1
Pn=handles.VA1
Pb=(handles.Ip3)*(RL+(handles.Rr))
ALF2=(ALF1)*((Pi+Pb)/(Pi+Pn))
set(handles.ALF2,'string',ALF2);

% To calculate Actual knee point Voltage
Vknee1=(ALF2)*(handles.Ip3)*(Rct1+Rb)
set(handles.Vknee1,'string',Vknee1);

% To calculate Actual Burden
VA2=(Vknee1/ALF2)-Rct1
set(handles.VA2,'string',VA2);

ALF3=(If1/(handles.Ip2))*Ktf
set(handles.ALF3,'string',ALF3);

% To calculate Actual Accuracy Limit factor
Pj=(handles.Ip3)*Rct2
Pn=handles.VA1
Pb=(handles.Ip3)*(RL+(handles.Rr))
ALF4=(ALF3)*((Pj+Pb)/(Pj+Pn));
set(handles.ALF4,'string',ALF4);

% To calculate 2nd ratio Actual knee point Voltage
Vknee3=(ALF4)*(handles.Ip3)*(Rct2+Rb);
set(handles.Vknee3,'string',Vknee3);
% To calculate 2nd ration Actual Burden
VA4=(Vknee3/ALF4)-Rct2;
set(handles.VA4,'string',VA4);
%Compare the Accuracy Limit Factor
i=1;
if ALF2<=handles.ALF20 && Vknee1<=handles.Vknee20 && VA2<=handles.VA20
e{i}=sprintf('CT is Adequate\n');
else
e{i}=sprintf('CT is not Adequate\n');
end
handles.list=[e];
set(handles.status,'string',handles.list);
guidata(hObject, handles);

% --- Executes on button press in pushbutton5.
function pushbutton5_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton5 (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 Zs.
function Zs_Callback(hObject, eventdata, handles)
% hObject    handle to Zs (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 Zs
```

```
% --- Executes on button press in pushbutton6.
function pushbutton6_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton6 (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 Zbs.
function Zbs_Callback(hObject, eventdata, handles)
% hObject    handle to Zbs (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 Zbs

% --- Executes on button press in pushbutton7.
function pushbutton7_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton7 (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 Rs.
function Rs_Callback(hObject, eventdata, handles)
% hObject    handle to Rs (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 Rs
% --- Executes on button press in pushbutton8.
function pushbutton8_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton8 (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 Xs.
function Xs_Callback(hObject, eventdata, handles)
% hObject    handle to Xs (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 Xs

% --- Executes on button press in pushbutton9.
function pushbutton9_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton9 (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 togglebutton5.
function togglebutton5_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton5 (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 togglebutton5
```

```
% --- Executes on button press in pushbutton10.
function pushbutton10_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton10 (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 Zbl.
function Zbl_Callback(hObject, eventdata, handles)
% hObject    handle to Zbl (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 Zbl

% --- Executes on button press in pushbutton11.
function pushbutton11_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton11 (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 togglebutton7.
function togglebutton7_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton7 (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 togglebutton7
% --- Executes on button press in pushbutton12.
function pushbutton12_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton12 (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 T1.
function T1_Callback(hObject, eventdata, handles)
% hObject    handle to T1 (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 T1

% --- Executes on button press in Rl.
function Rl_Callback(hObject, eventdata, handles)
% hObject    handle to Rl (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 Rl

% --- Executes on button press in Xl.
function Xl_Callback(hObject, eventdata, handles)
% hObject    handle to Xl (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 Xl

% --- Executes on button press in pushbutton13.
```

```
function pushbutton13_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton13 (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 togglebutton9.
function togglebutton9_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton9 (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 togglebutton9

% --- Executes on button press in pushbutton14.
function pushbutton14_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton14 (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 ZT.
function ZT_Callback(hObject, eventdata, handles)
% hObject    handle to ZT (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 ZT
% --- Executes on button press in pushbutton15.
function pushbutton15_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton15 (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 Ktf.
function Ktf_Callback(hObject, eventdata, handles)
% hObject    handle to Ktf (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 Ktf

% --- Executes on button press in pushbutton16.
function pushbutton16_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton16 (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 Krem.
function Krem_Callback(hObject, eventdata, handles)
% hObject    handle to Krem (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 Krem

% --- Executes on button press in pushbutton17.
function pushbutton17_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton17 (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 RL.
function RL_Callback(hObject, eventdata, handles)
% hObject    handle to RL (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 RL

% --- Executes on button press in Ip.
function Ip_Callback(hObject, eventdata, handles)
% hObject    handle to Ip (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 Ip
% --- Executes on button press in togglebutton13.
function togglebutton13_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton13 (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 togglebutton13
% --- Executes on button press in togglebutton14.
function togglebutton14_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton14 (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 togglebutton14

% --- Executes on button press in togglebutton15.
function togglebutton15_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton15 (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 togglebutton15

% --- Executes on button press in togglebutton17.
function togglebutton17_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton17 (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 togglebutton17

% --- Executes on button press in togglebutton18.
function togglebutton18_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton18 (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 togglebutton18
```

```
% --- Executes on button press in Iefc1.
function Iefc1_Callback(hObject, eventdata, handles)
% hObject    handle to Iefc1 (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 Iefc1

% --- Executes on button press in Iefc2.
function Iefc2_Callback(hObject, eventdata, handles)
% hObject    handle to Iefc2 (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 Iefc2
% --- Executes on button press in Calculate.
function Calculate_Callback(hObject, eventdata, handles)
% hObject    handle to Calculate (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 C2.
function C2_Callback(hObject, eventdata, handles)
% hObject    handle to C2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
core2;

% --- Executes on button press in Total.
function Total_Callback(hObject, eventdata, handles)
% hObject    handle to Total (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 Total

function MVA_Callback(hObject, eventdata, handles)
% hObject    handle to MVA (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 MVA as text
%        str2double(get(hObject,'String')) returns contents of MVA as a
double

handles.MVA=str2double(get(hObject,'string'));
if isnan(handles.MVA)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

function edit31_Callback(hObject, eventdata, handles)
% hObject    handle to Io (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 Io as text
```

```
%        str2double(get(hObject,'String')) returns contents of Io as a
double

% --- Executes during object creation, after setting all properties.
function edit31_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Io (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 pushbutton18.
function pushbutton18_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton18 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% --- Executes during object creation, after setting all properties.
function MVA_CreateFcn(hObject, eventdata, handles)
% hObject    handle to MVA (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 pushbutton19.
function pushbutton19_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton19 (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 togglebutton21.
function togglebutton21_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton21 (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 togglebutton21

% --- Executes on button press in togglebutton22.
function togglebutton22_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton22 (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 togglebutton22

% --- Executes on button press in togglebutton23.
function togglebutton23_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton23 (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 togglebutton23
% --- Executes on button press in togglebutton24.
function togglebutton24_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton24 (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 togglebutton24

% --- Executes on button press in togglebutton25.
function togglebutton25_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton25 (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 togglebutton25

% --- Executes on button press in togglebutton26.
function togglebutton26_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton26 (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 togglebutton26

% --- Executes on button press in togglebutton27.
function togglebutton27_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton27 (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 togglebutton27

% --- Executes on button press in pushbutton20.
function pushbutton20_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton20 (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 togglebutton28.
function togglebutton28_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton28 (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 togglebutton28

% --- Executes on button press in togglebutton29.
```

```
function togglebutton29_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton29 (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 togglebutton29

% --- Executes on button press in togglebutton30.
function togglebutton30_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton30 (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 togglebutton30

% --- Executes on button press in togglebutton31.
function togglebutton31_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton31 (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 togglebutton31

% --- Executes on button press in togglebutton32.
function togglebutton32_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton32 (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 togglebutton32

% --- Executes on button press in togglebutton33.
function togglebutton33_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton33 (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 togglebutton33

% --- Executes on button press in togglebutton34.
function togglebutton34_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton34 (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 togglebutton34

% --- Executes on button press in togglebutton35.
function togglebutton35_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton35 (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 togglebutton35
```

```
% --- Executes on button press in togglebutton36.
function togglebutton36_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton36 (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 togglebutton36
% --- Executes on button press in togglebutton37.
function togglebutton37_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton37 (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 togglebutton37
% --- Executes on button press in togglebutton38.
function togglebutton38_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton38 (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 togglebutton38

% --- Executes on button press in togglebutton39.
function togglebutton39_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton39 (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 togglebutton39

% --- Executes on button press in togglebutton40.
function togglebutton40_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton40 (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 togglebutton40

% --- Executes on button press in togglebutton41.
function togglebutton41_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton41 (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 togglebutton41

% --- Executes on button press in togglebutton42.
function togglebutton42_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton42 (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 togglebutton42

% --- Executes on button press in togglebutton43.
function togglebutton43_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton43 (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 togglebutton43

function status_Callback(hObject, eventdata, handles)
% hObject    handle to status (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 status as text
%        str2double(get(hObject,'String')) returns contents of status as
a double

% --- Executes during object creation, after setting all properties.
function status_CreateFcn(hObject, eventdata, handles)
% hObject    handle to status (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 ALF20_Callback(hObject, eventdata, handles)
% hObject    handle to ALF20 (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 ALF20 as text
%        str2double(get(hObject,'String')) returns contents of ALF20 as
a double

handles.ALF20=str2double(get(hObject,'string'));
if isnan(handles.ALF20)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function ALF20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ALF20 (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 Vknee20_Callback(hObject, eventdata, handles)
% hObject    handle to Vknee20 (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 Vknee20 as text
%        str2double(get(hObject,'String')) returns contents of Vknee20
as a double

handles.Vknee20=str2double(get(hObject,'string'));
if isnan(handles.Vknee20)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Vknee20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Vknee20 (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 VA20_Callback(hObject, eventdata, handles)
% hObject    handle to VA20 (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 VA20 as text
%        str2double(get(hObject,'String')) returns contents of VA20 as a
double

handles.VA20=str2double(get(hObject,'string'));
if isnan(handles.VA20)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function VA20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to VA20 (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 pushbutton24.
function pushbutton24_Callback(hObject, eventdata, handles)
```

```
% hObject    handle to pushbutton24 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
core2;

% --- Executes on button press in togglebutton44.
function togglebutton44_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton44 (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 togglebutton44

% --- Executes on button press in togglebutton45.
function togglebutton45_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton45 (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 togglebutton45

% --- Executes on button press in togglebutton46.
function togglebutton46_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton46 (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 togglebutton46

% --- Executes on button press in togglebutton47.
function togglebutton47_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton47 (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 togglebutton47

% --- Executes on button press in togglebutton48.
function togglebutton48_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton48 (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 togglebutton48

% --- Executes on button press in togglebutton49.
function togglebutton49_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton49 (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 togglebutton49

% --- Executes on button press in togglebutton50.
function togglebutton50_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton50 (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 togglebutton50
% --- Executes on button press in togglebutton51.
function togglebutton51_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton51 (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 togglebutton51

% --- Executes on button press in togglebutton52.
function togglebutton52_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton52 (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 togglebutton52

% --- Executes on button press in togglebutton53.
function togglebutton53_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton53 (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 togglebutton53

% --- Executes on button press in togglebutton54.
function togglebutton54_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton54 (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 togglebutton54

% --- Executes on button press in togglebutton55.
function togglebutton55_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton55 (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 togglebutton55

% --- Executes on button press in togglebutton56.
function togglebutton56_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton56 (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 togglebutton56

% --- Executes on button press in togglebutton57.
function togglebutton57_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton57 (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 togglebutton57
% --- Executes on button press in togglebutton58.
function togglebutton58_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton58 (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 togglebutton58

% --- Executes on button press in togglebutton59.
function togglebutton59_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton59 (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 togglebutton59

% --- Executes on button press in togglebutton60.
function togglebutton60_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton60 (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 togglebutton60

% --- Executes on button press in togglebutton61.
function togglebutton61_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton61 (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 togglebutton61

% --- Executes on button press in togglebutton62.
function togglebutton62_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton62 (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 togglebutton62

% --- Executes on button press in togglebutton63.
function togglebutton63_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton63 (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 togglebutton63

% --- Executes on button press in togglebutton64.
function togglebutton64_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton64 (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 togglebutton64

% --- Executes on button press in togglebutton65.
function togglebutton65_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton65 (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 togglebutton65

% --- Executes on button press in togglebutton66.
function togglebutton66_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton66 (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 togglebutton66

% --- Executes on button press in togglebutton67.
function togglebutton67_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton67 (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 togglebutton67

% --- Executes on button press in togglebutton68.
function togglebutton68_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton68 (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 togglebutton68
% --- Executes on button press in togglebutton69.
function togglebutton69_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton69 (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 togglebutton69

% --- Executes on button press in togglebutton70.
function togglebutton70_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton70 (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 togglebutton70

% --- Executes on button press in togglebutton71.
function togglebutton71_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton71 (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 togglebutton71
```

```
% --- Executes on button press in pushbutton25.
function pushbutton25_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton25 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

x1=[0.0010 0.0020 0.0040 0.0050 0.0080 0.0100 0.0200 0.0400 0.0500
0.0800 0.1000 0.2000 0.4000 0.5000 0.8000 1.000]
y1=[2.2 4.5 13.9 19.4 35.7 48.9 131.7 343.1 416.4 512.2 538.5 586.8
613.2 620.1 634.8 641.8]
y2=[2.1 5.4 15.8 20.8 39.5 53.6 139.0 344.6 421.3 515.9 540.3 580.9
604.4 611.3 625.1 631.8]
y3=[3.2 5.8 18.6 23.9 47.7 65.9 183.4 412.8 463.8 521.1 537.2 571.8
594.4 600.8 614.4 621.5]

figure
axes('FontSize',13)
loglog(x1,y1,'-
ro','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','g','MarkerS
ize',2)
hold on
loglog(x1,y2,'-
yo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','r','MarkerS
ize',2)
hold on
loglog(x1,y3,'-
bo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','w','MarkerS
ize',2)
hold off
h = legend('Red Phase','Yellow Phase','Blue Phase',10);
grid on
xlabel({'Current in mA';'Current'})
ylabel({'Voltage in V';'Voltage'})
title('CT SATURATION PLOT','fontsize',15,'fontweight','b');
text(0.0580,350.1,'(0.0712,496.4)','FontSize',10,'fontweight','b')
text(0.0580,400.1,'(0.0678,491.7)','FontSize',10,'fontweight','b')
text(0.0580,450.1,'(0.0504,465.4)','FontSize',10,'fontweight','b')
text(0.01,14,'ASA 10/50Vkp:CT R = 496.4 V; CT Y = 491.7V: CT B =
465.4V','FontSize',12,'fontweight','b')
text(0.01,11,'Vkp = 248.2
V;245.85V;232.7V','FontSize',12,'fontweight','b')
```

APPENDIX E– CORE 3–BACK UP DISTANCE PROTECTION (Core.m)

****

CODES FOR CORE 3 – BACKUP DISTANCE PROTECTION
PROGRAM DISIGNED BY :-
AHMAD NAJMI ABDULLAH (KGD070005)

****

```
function varargout = core2(varargin)
% CORE2 M-file for core2.fig
%      CORE2, by itself, creates a new CORE2 or raises the existing
%      singleton*.
%      H = CORE2 returns the handle to a new CORE2 or the handle to
%      the existing singleton*.
%      CORE2('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in CORE2.M with the given input
      arguments.
%      CORE2('Property','Value',...) creates a new CORE2 or raises the
%      existing singleton*.  Starting from the left, property value
      pairs are
%      applied to the GUI before core2_OpeningFunction gets called.  An
%      unrecognized property name or invalid value makes property
      application
%      stop.  All inputs are passed to core2_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 core2

% Last Modified by GUIDE v2.5 12-Nov-2009 15:32:31

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @core2_OpeningFcn, ...
                   'gui_OutputFcn',  @core2_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 core2 is1 made visible.
function core2_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 core2 (see VARARGIN)

backgroundImage = importdata('p441.jpg');
axes(handles.blockdiagram2_pic);
image(backgroundImage);
axis off
% Choose default command line output for core2
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes core2 wait for user response (see UIRESUME)
% uiwait(handles.figure1);

% --- Outputs from this function are returned to the command line.
function varargout = core2_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 edit1_Callback(hObject, eventdata, handles)
% hObject    handle to edit1 (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 edit1 as text
%        str2double(get(hObject,'String')) returns contents of edit1 as
a double

% --- Executes during object creation, after setting all properties.
function edit1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit1 (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 Ip1_Callback(hObject, eventdata, handles)
% hObject    handle to Ip1 (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 Ip1 as text
%        str2double(get(hObject,'String')) returns contents of Ip1 as a
double

handles.Ip1=str2double(get(hObject,'string'));
if isnan(handles.Ip1)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip1 (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 Ip2_Callback(hObject, eventdata, handles)
% hObject    handle to Ip2 (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 Ip2 as text
%        str2double(get(hObject,'String')) returns contents of Ip2 as a
double

handles.Ip2=str2double(get(hObject,'string'));
if isnan(handles.Ip2)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip2 (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 Ip3_Callback(hObject, eventdata, handles)
% hObject    handle to Ip3 (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 Ip3 as text
%        str2double(get(hObject,'String')) returns contents of Ip3 as a
double

handles.Ip3=str2double(get(hObject,'string'));
if isnan(handles.Ip3)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip3_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip3 (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 Io_Callback(hObject, eventdata, handles)
% hObject    handle to Io (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 Io as text
%        str2double(get(hObject,'String')) returns contents of Io as a
double

% --- Executes during object creation, after setting all properties.
function Io_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Io (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 Rr_Callback(hObject, eventdata, handles)
% hObject    handle to Rr (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 Rr as text
%        str2double(get(hObject,'String')) returns contents of Rr as a
double
```

```
handles.Rr=str2double(get(hObject,'string'));
if isnan(handles.Rr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Rr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Rr (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 VA1_Callback(hObject, eventdata, handles)
% hObject    handle to VA1 (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 VA1 as text
%        str2double(get(hObject,'String')) returns contents of VA1 as a
double

handles.VA1=str2double(get(hObject,'string'));
if isnan(handles.VA1)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function VA1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to VA1 (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 pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% To calculate highest CT Secondary resistance
Rct1=(handles.Ip1)*(handles.Ohm);
```

```
set(handles.Rct1,'string',Rct1);

% to calculate the Ext.Fault Current for 1st ratio
If1=(handles.If*1000)/(handles.Ip1);
set(handles.If1,'string',If1);

% To calculate the Actual Connected resistance
RL=2*(handles.Ic)*(handles.Cr);
Rb=RL+(handles.Rr);
set(handles.Rb,'string',Rb);

% To calculate Knee point Voltage
Vknee=
((handles.VA1*handles.ALF)/handles.Ip3)+(handles.ALF*handles.Ip3*Rct1);
set(handles.Vknee,'string',Vknee);

% To calculate Acccurate Burden
VA=(Vknee/handles.ALF)-Rct1;
set(handles.VA,'string',VA);

function Vs_Callback(hObject, eventdata, handles)
% hObject    handle to Vs (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 Vs as text
%        str2double(get(hObject,'String')) returns contents of Vs as a
double

handles.Vs=str2double(get(hObject,'string'));
if isnan(handles.Vs)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Vs_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Vs (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 If_Callback(hObject, eventdata, handles)
% hObject    handle to If (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 If as text
%        str2double(get(hObject,'String')) returns contents of If as a
double
```

```
handles.If=str2double(get(hObject,'string'));
if isnan(handles.If)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function If_CreateFcn(hObject, eventdata, handles)
% hObject    handle to If (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 f_Callback(hObject, eventdata, handles)
% hObject    handle to f (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 f as text
%        str2double(get(hObject,'String')) returns contents of f as a
double

handles.f=str2double(get(hObject,'string'));
if isnan(handles.f)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function f_CreateFcn(hObject, eventdata, handles)
% hObject    handle to f (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 Ic_Callback(hObject, eventdata, handles)
% hObject    handle to Ic (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 Ic as text
%        str2double(get(hObject,'String')) returns contents of Ic as a
double
```

```
handles.Ic=str2double(get(hObject,'string'));
if isnan(handles.Ic)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ic_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ic (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 Cc_Callback(hObject, eventdata, handles)
% hObject    handle to Cc (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 Cc as text
%        str2double(get(hObject,'String')) returns contents of Cc as a
double

handles.Cc=str2double(get(hObject,'string'));
if isnan(handles.Cc)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Cc_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Cc (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 Cr_Callback(hObject, eventdata, handles)
% hObject    handle to Cr (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 Cr as text
%        str2double(get(hObject,'String')) returns contents of Cr as a
double
```

```
handles.Cr=str2double(get(hObject,'string'));
if isnan(handles.Cr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Cr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Cr (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 Xr_Callback(hObject, eventdata, handles)
% hObject    handle to Xr (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 Xr as text
%        str2double(get(hObject,'String')) returns contents of Xr as a
double

handles.Xr=str2double(get(hObject,'string'));
if isnan(handles.Xr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)
% --- Executes during object creation, after setting all properties.
function Xr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Xr (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 L_Callback(hObject, eventdata, handles)
% hObject    handle to L (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 L as text
%        str2double(get(hObject,'String')) returns contents of L as a
double
```

```
handles.L=str2double(get(hObject,'string'));
if isnan(handles.L)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function L_CreateFcn(hObject, eventdata, handles)
% hObject    handle to L (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 Ohm_Callback(hObject, eventdata, handles)
% hObject    handle to Ohm (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 Ohm as text
%        str2double(get(hObject,'String')) returns contents of Ohm as a
double

handles.Ohm=str2double(get(hObject,'string'));
if isnan(handles.Ohm)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)
% --- Executes during object creation, after setting all properties.
function Ohm_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ohm (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 Kr_Callback(hObject, eventdata, handles)
% hObject    handle to Kr (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 Kr as text
%        str2double(get(hObject,'String')) returns contents of Kr as a
double
```

```
handles.Kr=str2double(get(hObject,'string'));
if isnan(handles.Kr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Kr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Kr (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 ALF_Callback(hObject, eventdata, handles)
% hObject    handle to ALF (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 ALF as text
%        str2double(get(hObject,'String')) returns contents of ALF as a
double

handles.ALF=str2double(get(hObject,'string'));
if isnan(handles.ALF)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function ALF_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ALF (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 pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% To calculate the Dc times constant of the applicable fault loop
T1=((handles.Xr)/(2*pi*(handles.f)));
```

```
set(handles.T1,'string',T1);

% To calculate the Source impedance
Zs=handles.Vs*1000/(sqrt(3)*handles.If*1000);
set(handles.Zs,'string',Zs);

% To calculate the Real part of Source impedance
Rs=(1.1)*(Zs)*((cos((83.08*pi)/180)));
set(handles.Rs,'string',Rs);

% To calculate the imag part of Source impedance
Xs=(1.1)*(Zs)*((sin((83.08*pi)/180)));
set(handles.Xs,'string',Xs);

% To Calculate the Actual Source impedance
Zbs=sqrt(Rs^2+Xs^2);
set(handles.Zbs,'string',Zbs);

% To Calculate the real part of Line Impedance
Rl=(0.2887)*(0.8)*(handles.L)*(cos((83.08*pi)/180));
set(handles.Rl,'string',Rl);

% To Calculate the imag part of Line Impedance
Xl=(0.2887)*(0.8)*(handles.L)*(sin((83.08*pi)/180));
set(handles.Xl,'string',Xl);

% To calculate the Actual Line Impedance
Zbl=sqrt(Rl^2+Xl^2);
set(handles.Zbl,'string',Zbl);
% To calculate the Lead resistance
RL=2*(handles.Ic)*(handles.Cr);
set(handles.RL,'string',RL);

% To calculate the overall Total impedance
ZT=sqrt(((Rs+Rl)^2)+((Xs+Xl)^2));
set(handles.ZT,'string',ZT);

% To calculate the transient overdimensioning factor
Ktf=0.75;
set(handles.Ktf,'string',Ktf);

% To calculate the transient overdimensioning that consider remanence
Krem=1/((1-handles.Kr));
set(handles.Krem,'string',Krem);

% to calculate full load current in primary
Ip=(handles.MVA*1000000)/(handles.Vs*1000*sqrt(3));
set(handles.Ip,'string',Ip);

% --- Executes on button press in pushbutton3.
function pushbutton3_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
core45;
% --- Executes on button press in pushbutton4.
```

```
function pushbutton4_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

Ktf=0.75;
Zs=handles.Vs*1000/(sqrt(3)*handles.If*1000);
If1=(1.1*(handles.Vs*1000/sqrt(3)))/Zs;
ALF1=(If1/(handles.Ip1))*Ktf;
set(handles.ALF1,'string',ALF1);

RL=2*(handles.Ic)*(handles.Cr);
Rct1=(handles.Ip1)*(handles.Ohm);
Rb=RL+(handles.Rr);

% To calculate Actual Accuracy Limit factor
Pi=(handles.Ip3)*Rct1;
Pn=handles.VA1;
Pb=(handles.Ip3)*(RL+(handles.Rr));
ALF2=(ALF1)*((Pi+Pb)/(Pi+Pn));
set(handles.ALF2,'string',ALF2);

% To calculate Actual knee point Voltage
Vknee1=(ALF2)*(handles.Ip3)*(Rct1+Rb);
set(handles.Vknee1,'string',Vknee1);
% To calculate Actual Burden
VA2=(Vknee1/ALF2)-Rct1;
set(handles.VA2,'string',VA2);

% --- Executes on button press in pushbutton5.
function pushbutton5_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton5 (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 Zs.
function Zs_Callback(hObject, eventdata, handles)
% hObject    handle to Zs (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 Zs
% --- Executes on button press in pushbutton6.
function pushbutton6_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton6 (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 Zbs.
function Zbs_Callback(hObject, eventdata, handles)
% hObject    handle to Zbs (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 Zbs

% --- Executes on button press in pushbutton7.
```

```
function pushbutton7_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton7 (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 Rs.
function Rs_Callback(hObject, eventdata, handles)
% hObject    handle to Rs (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 Rs

% --- Executes on button press in pushbutton8.
function pushbutton8_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton8 (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 Xs.
function Xs_Callback(hObject, eventdata, handles)
% hObject    handle to Xs (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 Xs
% --- Executes on button press in pushbutton9.
function pushbutton9_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton9 (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 togglebutton5.
function togglebutton5_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton5 (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 togglebutton5

% --- Executes on button press in pushbutton10.
function pushbutton10_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton10 (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 Zbl.
function Zbl_Callback(hObject, eventdata, handles)
% hObject    handle to Zbl (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 Zbl

% --- Executes on button press in pushbutton11.
function pushbutton11_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton11 (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 togglebutton7.
function togglebutton7_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton7 (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 togglebutton7

% --- Executes on button press in pushbutton12.
function pushbutton12_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton12 (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 T1.
function T1_Callback(hObject, eventdata, handles)
% hObject    handle to T1 (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 T1
% --- Executes on button press in Rl.
function Rl_Callback(hObject, eventdata, handles)
% hObject    handle to Rl (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 Rl

% --- Executes on button press in Xl.
function Xl_Callback(hObject, eventdata, handles)
% hObject    handle to Xl (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 Xl

% --- Executes on button press in pushbutton13.
function pushbutton13_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton13 (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 togglebutton9.
function togglebutton9_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton9 (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 togglebutton9

% --- Executes on button press in pushbutton14.
```

```
function pushbutton14_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton14 (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 ZT.
function ZT_Callback(hObject, eventdata, handles)
% hObject    handle to ZT (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 ZT

% --- Executes on button press in pushbutton15.
function pushbutton15_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton15 (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 Ktf.
function Ktf_Callback(hObject, eventdata, handles)
% hObject    handle to Ktf (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 Ktf

% --- Executes on button press in pushbutton16.
function pushbutton16_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton16 (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 Krem.
function Krem_Callback(hObject, eventdata, handles)
% hObject    handle to Krem (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 Krem

% --- Executes on button press in pushbutton17.
function pushbutton17_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton17 (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 RL.
function RL_Callback(hObject, eventdata, handles)
% hObject    handle to RL (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 RL

% --- Executes on button press in Ip.
function Ip_Callback(hObject, eventdata, handles)
% hObject    handle to Ip (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 Ip

% --- Executes on button press in togglebutton13.
function togglebutton13_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton13 (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 togglebutton13
% --- Executes on button press in togglebutton14.
function togglebutton14_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton14 (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 togglebutton14
% --- Executes on button press in togglebutton15.
function togglebutton15_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton15 (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 togglebutton15

% --- Executes on button press in togglebutton17.
function togglebutton17_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton17 (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 togglebutton17
% --- Executes on button press in togglebutton18.
function togglebutton18_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton18 (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 togglebutton18

% --- Executes on button press in If1.
function If1_Callback(hObject, eventdata, handles)
% hObject    handle to If1 (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 If1

% --- Executes on button press in If2.
function If2_Callback(hObject, eventdata, handles)
% hObject    handle to If2 (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 If2
```

```
% --- Executes on button press in pushbutton18.
function pushbutton18_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton18 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

function MVA_Callback(hObject, eventdata, handles)
% hObject    handle to MVA (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 MVA as text
%        str2double(get(hObject,'String')) returns contents of MVA as a
double

handles.Vs=str2double(get(hObject,'string'));
if isnan(handles.Vs)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function MVA_CreateFcn(hObject, eventdata, handles)
% hObject    handle to MVA (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 togglebutton21.
function togglebutton21_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton21 (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 togglebutton21

% --- Executes on button press in togglebutton22.
function togglebutton22_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton22 (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 togglebutton22

% --- Executes on button press in togglebutton23.
function togglebutton23_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton23 (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 togglebutton23

% --- Executes on button press in togglebutton24.
function togglebutton24_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton24 (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 togglebutton24

% --- Executes on button press in togglebutton25.
function togglebutton25_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton25 (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 togglebutton25

% --- Executes on button press in togglebutton26.
function togglebutton26_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton26 (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 togglebutton26

% --- Executes on button press in togglebutton27.
function togglebutton27_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton27 (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 togglebutton27

% --- Executes on button press in togglebutton28.
function togglebutton28_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton28 (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 togglebutton28

% --- Executes on button press in togglebutton29.
function togglebutton29_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton29 (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 togglebutton29

% --- Executes on button press in togglebutton30.
function togglebutton30_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton30 (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 togglebutton30

% --- Executes on button press in togglebutton31.
function togglebutton31_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton31 (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 togglebutton31

% --- Executes on button press in togglebutton32.
function togglebutton32_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton32 (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 togglebutton32

% --- Executes on button press in togglebutton33.
function togglebutton33_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton33 (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 togglebutton33
% --- Executes on button press in togglebutton34.
function togglebutton34_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton34 (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 togglebutton34

% --- Executes on button press in togglebutton35.
function togglebutton35_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton35 (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 togglebutton35

% --- Executes on button press in togglebutton36.
function togglebutton36_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton36 (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 togglebutton36

% --- Executes on button press in togglebutton37.
function togglebutton37_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton37 (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 togglebutton37

% --- Executes on button press in togglebutton38.
function togglebutton38_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton38 (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 togglebutton38
% --- Executes on button press in togglebutton39.
function togglebutton39_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton39 (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 togglebutton39

% --- Executes on button press in togglebutton40.
function togglebutton40_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton40 (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 togglebutton40
% --- Executes on button press in togglebutton41.
function togglebutton41_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton41 (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 togglebutton41

% --- Executes on button press in togglebutton42.
function togglebutton42_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton42 (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 togglebutton42

% --- Executes on button press in pushbutton22.
function pushbutton22_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton22 (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 Rct1.
function Rct1_Callback(hObject, eventdata, handles)
% hObject    handle to Rct1 (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 Rct1

% --- Executes on button press in togglebutton43.
function togglebutton43_Callback(hObject, eventdata, handles)
```

```
% hObject    handle to togglebutton43 (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 togglebutton43

% --- Executes on button press in togglebutton44.
function togglebutton44_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton44 (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 togglebutton44

% --- Executes on button press in togglebutton45.
function togglebutton45_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton45 (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 togglebutton45

% --- Executes on button press in togglebutton46.
function togglebutton46_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton46 (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 togglebutton46

% --- Executes on button press in togglebutton47.
function togglebutton47_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton47 (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 togglebutton47

% --- Executes on button press in togglebutton48.
function togglebutton48_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton48 (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 togglebutton48

% --- Executes on button press in togglebutton49.
function togglebutton49_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton49 (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 togglebutton49

% --- Executes on button press in togglebutton50.
function togglebutton50_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton50 (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 togglebutton50

% --- Executes on button press in togglebutton51.
function togglebutton51_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton51 (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 togglebutton51

% --- Executes on button press in togglebutton52.
function togglebutton52_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton52 (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 togglebutton52

% --- Executes on button press in togglebutton53.
function togglebutton53_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton53 (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 togglebutton53

% --- Executes on button press in togglebutton54.
function togglebutton54_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton54 (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 togglebutton54

% --- Executes on button press in togglebutton55.
function togglebutton55_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton55 (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 togglebutton55

% --- Executes on button press in togglebutton56.
function togglebutton56_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton56 (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 togglebutton56

% --- Executes on button press in togglebutton57.
function togglebutton57_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton57 (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 togglebutton57

% --- Executes on button press in togglebutton58.
function togglebutton58_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton58 (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 togglebutton58

% --- Executes on button press in togglebutton59.
function togglebutton59_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton59 (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 togglebutton59

% --- Executes on button press in togglebutton60.
function togglebutton60_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton60 (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 togglebutton60

% --- Executes on button press in togglebutton61.
function togglebutton61_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton61 (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 togglebutton61

% --- Executes on button press in togglebutton62.
function togglebutton62_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton62 (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 togglebutton62

% --- Executes on button press in togglebutton63.
function togglebutton63_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton63 (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 togglebutton63

% --- Executes on button press in togglebutton64.
function togglebutton64_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton64 (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 togglebutton64

% --- Executes on button press in togglebutton65.
function togglebutton65_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton65 (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 togglebutton65

% --- Executes on button press in togglebutton66.
function togglebutton66_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton66 (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 togglebutton66

% --- Executes on button press in togglebutton67.
function togglebutton67_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton67 (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 togglebutton67

% --- Executes on button press in togglebutton68.
function togglebutton68_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton68 (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 togglebutton68

% --- Executes during object creation, after setting all properties.
function ALF20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ALF20 (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 pushbutton23.
function pushbutton23_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton23 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

```
x1=[0.0010 0.0020 0.0040 0.0050 0.0080 0.0100 0.0200 0.0400 0.0500
0.0800 0.1000 0.2000 0.4000 0.5000 0.8000 1.000]
y1=[2.8 5.6 20.3 28.0 53.0 72.6 189.8 487.7 575.5 659.1 678.2 712.7
736.8 744.4 760.0 767.8]
y2=[2.8 5.6 19.4 26.7 48.4 67.4 184.4 471.2 559.2 646.7 667.1 705.2
730.0 737.4 753.4 761.8]
y3=[3.6 7.2 18.0 24.8 47.6 67.0 179.4 438.4 521.0 615.7 642.8 703.4
741.4 750.7 768.3 776.6]

figure
axes('FontSize',13)
loglog(x1,y1,'-
ro','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','g','MarkerS
ize',2)
hold on
loglog(x1,y2,'-
yo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','r','MarkerS
ize',2)
hold on
loglog(x1,y3,'-
bo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','w','MarkerS
ize',2)
hold off
h = legend('Red Phase','Yellow Phase','Blue Phase',10);
grid on
xlabel({'Current in mA';'Current'})
ylabel({'Voltage in V';'Voltage'})
title('CT SATURATION PLOT','fontsize',15,'fontweight','b');
text(0.0580,500.1,'(0.0528,591.4)','FontSize',10,'fontweight','b')
text(0.0580,600.1,'(0.0540,582.5)','FontSize',10,'fontweight','b')
text(0.0580,700.1,'(0.0626,576.9)','FontSize',10,'fontweight','b')
text(0.01,14,'ASA 10/50Vkp:CT R = 591.4 V; CT Y = 582.5V: CT B =
576.9V','FontSize',12,'fontweight','b')
text(0.01,11,'Vkp =
295.7V;291.25V;288.45V','FontSize',12,'fontweight','b')
```

APPENDIX F - CORE 4 & 5 – HIGH IMPEDANCE BUSBAR PROTECTION (MAIN AND CHECK ZONE) (Core45.m)

****

CODES FOR CORE 4 & 5 – HIGH IMPEDANCE BUSBAR PROTECTION
PROGRAM DISIGNED BY :-
AHMAD NAJMI ABDULLAH (KGD070005)

****

```
function varargout = core45(varargin)
% CORE45 M-file for core45.fig
%      CORE45, by itself, creates a new CORE45 or raises the existing
%      singleton*.
%      H = CORE45 returns the handle to a new CORE45 or the handle to
%      the existing singleton*.
%      CORE45('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in CORE45.M with the given input
      arguments.
%      CORE45('Property','Value',...) creates a new CORE45 or raises the
%      existing singleton*.  Starting from the left, property value
      pairs are
%      applied to the GUI before core45_OpeningFunction gets called.  An
%      unrecognized property name or invalid value makes property
      application
%      stop.  All inputs are passed to core45_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 core45

% Last Modified by GUIDE v2.5 12-Nov-2009 15:35:50

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @core45_OpeningFcn, ...
                   'gui_OutputFcn',  @core45_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 core45 is made visible.
function core45_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 core45 (see VARARGIN)
backgroundImage = importdata('mcag34.jpg');
axes(handles.mcag34_pic);
image(backgroundImage);
axis off
% Choose default command line output for core45
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes core45 wait for user response (see UIRESUME)
% uiwait(handles.figure1);

% --- Outputs from this function are returned to the command line.
function varargout = core45_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;

% --- Executes on button press in togglebutton1.
function togglebutton1_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton1 (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 togglebutton1

% --- Executes on button press in togglebutton2.
function togglebutton2_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton2 (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 togglebutton2

% --- Executes on button press in togglebutton3.
function togglebutton3_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton3 (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 togglebutton3
% --- Executes on button press in togglebutton4.
function togglebutton4_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton4 (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 togglebutton4

% --- Executes on button press in pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton1 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% To calculate highest CT Secondary resistance
Rct1=(handles.Ip1)*(handles.ohm);
set(handles.Rct1,'string',Rct1);

% to calculate the Ext.Fault Current for 1st ratio
RL=2*(handles.Ic)*(handles.Cr);
Isf=handles.If*1000/handles.Ip1;
Vm=(Isf)*(Rct1+RL);
set(handles.Vm,'string',Vm);

% To calculate Knee point Voltage
Vknee=3*Vm;
set(handles.Vknee,'string',Vknee);

% To calculate Acccurate Burden
VA=(Vknee/handles.ALF)-Rct1;
set(handles.VA,'string',VA);

% --- Executes on button press in pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

Ktf=0.75;
Zs=handles.Vs*1000/(sqrt(3)*handles.If*1000);
If1=(1.1*(handles.Vs*1000/sqrt(3)))/Zs;
ALF1=(If1/handles.Ip1)*Ktf;
set(handles.ALF1,'string',ALF1);

RL=2*(handles.Ic)*(handles.Cr);
Rct1=(handles.Ip1)*(handles.ohm);
Rb=RL+(handles.Rr);

% To calculate Actual Accuracy Limit factor
Pi=(handles.Ip3)*Rct1;
Pn=handles.VA1;
Pb=(handles.Ip3)*(RL+(handles.Rr));
ALF2=(ALF1)*((Pi+Pb)/(Pi+Pn));
set(handles.ALF2,'string',ALF2);
% To calculate Actual knee point Voltage
Vknee1=(ALF2)*(handles.Ip3)*(Rct1+Rb);
set(handles.Vknee1,'string',Vknee1);

% To calculate Actual Burden
VA2=(Vknee1/ALF2)-Rct1;
set(handles.VA2,'string',VA2);
```

```
%Compare the Accuracy Limit Factor
i=1;
if ALF2<=handles.ALF20 && Vknee1<=handles.Vknee20 && VA2<=handles.VA20
e{i}=sprintf('CT is Adequate\n');
else
e{i}=sprintf('CT is not Adequate\n');
end
handles.list=[e];
set(handles.status,'string',handles.list);
guidata(hObject, handles);

% --- Executes on button press in togglebutton5.
function togglebutton5_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton5 (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 togglebutton5

% --- Executes on button press in togglebutton6.
function togglebutton6_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton6 (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 togglebutton6

% --- Executes on button press in togglebutton7.
function togglebutton7_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton7 (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 togglebutton7

% --- Executes on button press in togglebutton8.
function togglebutton8_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton8 (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 togglebutton8
% --- Executes on button press in togglebutton9.
function togglebutton9_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton9 (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 togglebutton9

% --- Executes on button press in togglebutton10.
function togglebutton10_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton10 (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 togglebutton10
```

```
% --- Executes on button press in togglebutton11.
function togglebutton11_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton11 (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 togglebutton11

% --- Executes on button press in togglebutton12.
function togglebutton12_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton12 (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 togglebutton12

% --- Executes on button press in togglebutton13.
function togglebutton13_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton13 (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 togglebutton13

% --- Executes on button press in togglebutton14.
function togglebutton14_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton14 (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 togglebutton14

% --- Executes on button press in togglebutton15.
function togglebutton15_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton15 (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 togglebutton15

% --- Executes on button press in togglebutton16.
function togglebutton16_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton16 (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 togglebutton16

% --- Executes on button press in togglebutton17.
function togglebutton17_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton17 (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 togglebutton17
```

```
% --- Executes on button press in togglebutton18.
function togglebutton18_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton18 (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 togglebutton18

% --- Executes on button press in togglebutton19.
function togglebutton19_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton19 (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 togglebutton19

% --- Executes on button press in togglebutton20.
function togglebutton20_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton20 (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 togglebutton20

% --- Executes on button press in togglebutton21.
function togglebutton21_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton21 (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 togglebutton21

function Ip2_Callback(hObject, eventdata, handles)
% hObject    handle to Ip2 (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 Ip2 as text
%        str2double(get(hObject,'String')) returns contents of Ip2 as a
double

% --- Executes during object creation, after setting all properties.
function Ip2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip2 (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 Ip3_Callback(hObject, eventdata, handles)
% hObject    handle to Ip3 (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 Ip3 as text
%        str2double(get(hObject,'String')) returns contents of Ip3 as a
double

handles.Ip3=str2double(get(hObject,'string'));
if isnan(handles.Ip3)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip3_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip3 (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 Rct1.
function Rct1_Callback(hObject, eventdata, handles)
% hObject    handle to Rct1 (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 Rct1

function Rr_Callback(hObject, eventdata, handles)
% hObject    handle to Rr (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 Rr as text
%        str2double(get(hObject,'String')) returns contents of Rr as a
double

handles.Rr=str2double(get(hObject,'string'));
if isnan(handles.Rr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)
% --- Executes during object creation, after setting all properties.
function Rr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Rr (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 VA1_Callback(hObject, eventdata, handles)
% hObject    handle to VA1 (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 VA1 as text
%        str2double(get(hObject,'String')) returns contents of VA1 as a
double

handles.VA1=str2double(get(hObject,'string'));
if isnan(handles.VA1)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function VA1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to VA1 (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 pushbutton3.
function pushbutton3_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton3 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
function Vs_Callback(hObject, eventdata, handles)
% hObject    handle to Vs (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 Vs as text
%        str2double(get(hObject,'String')) returns contents of Vs as a
double

handles.Vs=str2double(get(hObject,'string'));
if isnan(handles.Vs)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Vs_CreateFcn(hObject, eventdata, handles)
```

```
% hObject    handle to Vs (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 togglebutton23.
function togglebutton23_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton23 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% To calculate the Dc times constant of the applicable fault loop
T1=((handles.Xr)/(2*pi*(handles.f)));
set(handles.T1,'string',T1);

% To calculate the Source impedance
Zs=handles.Vs*1000/(sqrt(3)*handles.If*1000);
set(handles.Zs,'string',Zs);

% To calculate the Real part of Source impedance
Rs=(1.1)*(Zs)*((cos((83.08*pi)/180)));
set(handles.Rs,'string',Rs);

% To calculate the imag part of Source impedance
Xs=(1.1)*(Zs)*((sin((83.08*pi)/180)));
set(handles.Xs,'string',Xs);

% To Calculate the Actual Source impedance
Zbs=sqrt(Rs^2+Xs^2);
set(handles.Zbs,'string',Zbs);

% To Calculate the real part of Line Impedance
Rl=(0.2887)*(0.8)*(handles.L)*(cos((83.08*pi)/180));
set(handles.Rl,'string',Rl);

% To Calculate the imag part of Line Impedance
Xl=(0.2887)*(0.8)*(handles.L)*(sin((83.08*pi)/180));
set(handles.Xl,'string',Xl);

% To calculate the Actual Line Impedance
Zbl=sqrt(Rl^2+Xl^2);
set(handles.Zbl,'string',Zbl);

% To calculate the Lead resistance
RL=2*(handles.Ic)*(handles.Cr);
set(handles.RL,'string',RL);

% To calculate the overall Total impedance
ZT=sqrt(((Rs+Rl)^2)+((Xs+Xl)^2));
```

```
set(handles.ZT,'string',ZT);

% To calculate the transient overdimensioning factor
Ktf=0.75;
set(handles.Ktf,'string',Ktf);

% To calculate the transient overdimensioning that consider remanence
Krem=1/((1-handles.Kr));
set(handles.Krem,'string',Krem);

% to calculate full load current in primary
Ip=(handles.MVA*1000000)/(handles.Vs*1000*sqrt(3));
set(handles.Ip,'string',Ip);
% Hint: get(hObject,'Value') returns toggle state of togglebutton23

% --- Executes on button press in Rb.
function Rb_Callback(hObject, eventdata, handles)
% hObject    handle to Rb (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 Rb

handles.Rb=str2double(get(hObject,'string'));
if isnan(handles.Rb)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes on button press in togglebutton25.
function togglebutton25_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton25 (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 togglebutton25
% --- Executes on button press in Ip.
function Ip_Callback(hObject, eventdata, handles)
% hObject    handle to Ip (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 Ip

% --- Executes on button press in togglebutton27.
function togglebutton27_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton27 (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 togglebutton27

% --- Executes on button press in togglebutton28.
function togglebutton28_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton28 (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 togglebutton28

% --- Executes on button press in togglebutton29.
function togglebutton29_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton29 (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 togglebutton29

function If_Callback(hObject, eventdata, handles)
% hObject    handle to If (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 If as text
%        str2double(get(hObject,'String')) returns contents of If as a
double

handles.If=str2double(get(hObject,'string'));
if isnan(handles.If)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function If_CreateFcn(hObject, eventdata, handles)
% hObject    handle to If (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 togglebutton30.
function togglebutton30_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton30 (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 togglebutton30

function f_Callback(hObject, eventdata, handles)
% hObject    handle to f (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 f as text
%        str2double(get(hObject,'String')) returns contents of f as a
double
```

```
handles.f=str2double(get(hObject,'string'));
if isnan(handles.f)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function f_CreateFcn(hObject, eventdata, handles)
% hObject    handle to f (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 Xr_Callback(hObject, eventdata, handles)
% hObject    handle to Xr (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 Xr as text
%        str2double(get(hObject,'String')) returns contents of Xr as a
double

handles.Xr=str2double(get(hObject,'string'));
if isnan(handles.Xr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Xr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Xr (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 togglebutton31.
function togglebutton31_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton31 (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 togglebutton31

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

```
% hObject    handle to Ic (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 Ic as text
%        str2double(get(hObject,'String')) returns contents of Ic as a
double

handles.Ic=str2double(get(hObject,'string'));
if isnan(handles.Ic)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ic_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ic (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 togglebutton32.
function togglebutton32_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton32 (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 togglebutton32

function Cc_Callback(hObject, eventdata, handles)
% hObject    handle to Cc (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 Cc as text
%        str2double(get(hObject,'String')) returns contents of Cc as a
double

handles.Cc=str2double(get(hObject,'string'));
if isnan(handles.Cc)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Cc_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Cc (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 togglebutton33.
function togglebutton33_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton33 (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 togglebutton33

function Cr_Callback(hObject, eventdata, handles)
% hObject    handle to Cr (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 Cr as text
%        str2double(get(hObject,'String')) returns contents of Cr as a
double

handles.Cr=str2double(get(hObject,'string'));
if isnan(handles.Cr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Cr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Cr (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 togglebutton34.
function togglebutton34_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton34 (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 togglebutton34

function L_Callback(hObject, eventdata, handles)
% hObject    handle to L (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 L as text
%        str2double(get(hObject,'String')) returns contents of L as a
double

handles.L=str2double(get(hObject,'string'));
if isnan(handles.L)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function L_CreateFcn(hObject, eventdata, handles)
% hObject    handle to L (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 togglebutton35.
function togglebutton35_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton35 (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 togglebutton35

function ohm_Callback(hObject, eventdata, handles)
% hObject    handle to ohm (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 ohm as text
%        str2double(get(hObject,'String')) returns contents of ohm as a
double

handles.ohm=str2double(get(hObject,'string'));
if isnan(handles.ohm)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function ohm_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ohm (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 togglebutton36.
function togglebutton36_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton36 (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 togglebutton36

function Kr_Callback(hObject, eventdata, handles)
% hObject    handle to Kr (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 Kr as text
%        str2double(get(hObject,'String')) returns contents of Kr as a
double

handles.Kr=str2double(get(hObject,'string'));
if isnan(handles.Kr)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Kr_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Kr (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 togglebutton37.
function togglebutton37_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton37 (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 togglebutton37

function ALF_Callback(hObject, eventdata, handles)
% hObject    handle to ALF (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 ALF as text
%        str2double(get(hObject,'String')) returns contents of ALF as a
double
```

```
handles.ALF=str2double(get(hObject,'string'));
if isnan(handles.ALF)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function ALF_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ALF (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 pushbutton4.
function pushbutton4_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton4 (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 Zs.
function Zs_Callback(hObject, eventdata, handles)
% hObject    handle to Zs (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 Zs

% --- Executes on button press in pushbutton5.
function pushbutton5_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton5 (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 Zbs.
function Zbs_Callback(hObject, eventdata, handles)
% hObject    handle to Zbs (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 Zbs

% --- Executes on button press in pushbutton6.
function pushbutton6_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton6 (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 Rs.
function Rs_Callback(hObject, eventdata, handles)
```

```
% hObject    handle to Rs (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 Rs

% --- Executes on button press in pushbutton7.
function pushbutton7_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton7 (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 Xs.
function Xs_Callback(hObject, eventdata, handles)
% hObject    handle to Xs (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 Xs

% --- Executes on button press in pushbutton8.
function pushbutton8_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton8 (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 T1.
function T1_Callback(hObject, eventdata, handles)
% hObject    handle to T1 (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 T1

% --- Executes on button press in pushbutton9.
function pushbutton9_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton9 (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 Zbl.
function Zbl_Callback(hObject, eventdata, handles)
% hObject    handle to Zbl (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 Zbl

% --- Executes on button press in pushbutton10.
function pushbutton10_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton10 (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 Rl.
function Rl_Callback(hObject, eventdata, handles)
```

```
% hObject    handle to Rl (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 Rl

% --- Executes on button press in pushbutton11.
function pushbutton11_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton11 (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 Xl.
function Xl_Callback(hObject, eventdata, handles)
% hObject    handle to Xl (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 Xl

% --- Executes on button press in pushbutton12.
function pushbutton12_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton12 (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 togglebutton46.
function togglebutton46_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton46 (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 togglebutton46

% --- Executes on button press in pushbutton13.
function pushbutton13_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton13 (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 ZT.
function ZT_Callback(hObject, eventdata, handles)
% hObject    handle to ZT (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 ZT

% --- Executes on button press in pushbutton14.
function pushbutton14_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton14 (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 Ktf.
function Ktf_Callback(hObject, eventdata, handles)
% hObject    handle to Ktf (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 Ktf

% --- Executes on button press in pushbutton15.
function pushbutton15_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton15 (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 Krem.
function Krem_Callback(hObject, eventdata, handles)
% hObject    handle to Krem (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 Krem

% --- Executes on button press in pushbutton16.
function pushbutton16_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton16 (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 Rct2.
function Rct2_Callback(hObject, eventdata, handles)
% hObject    handle to Rct2 (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 Rct2

handles.Rct2=str2double(get(hObject,'string'));
if isnan(handles.Rct2)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

function Ip1_Callback(hObject, eventdata, handles)
% hObject    handle to Ip1 (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 Ip1 as text
%        str2double(get(hObject,'String')) returns contents of Ip1 as a
double

handles.Ip1=str2double(get(hObject,'string'));
if isnan(handles.Ip1)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Ip1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Ip1 (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 Vm.
function Vm_Callback(hObject, eventdata, handles)
% hObject    handle to Vm (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 Vm

handles.Vm=str2double(get(hObject,'string'));
if isnan(handles.Vm)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)
function Io_Callback(hObject, eventdata, handles)
% hObject    handle to Io (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 Io as text
%        str2double(get(hObject,'String')) returns contents of Io as a
double

handles.Io=str2double(get(hObject,'string'));
if isnan(handles.Io)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Io_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Io (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 pushbutton17.
function pushbutton17_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton17 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
```

```
function MVA_Callback(hObject, eventdata, handles)
% hObject    handle to MVA (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 MVA as text
%        str2double(get(hObject,'String')) returns contents of MVA as a
double

handles.MVA=str2double(get(hObject,'string'));
if isnan(handles.MVA)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function MVA_CreateFcn(hObject, eventdata, handles)
% hObject    handle to MVA (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 togglebutton52.
function togglebutton52_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton52 (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 togglebutton52

% --- Executes on button press in togglebutton53.
function togglebutton53_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton53 (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 togglebutton53

% --- Executes on button press in togglebutton54.
function togglebutton54_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton54 (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 togglebutton54

% --- Executes on button press in togglebutton55.
function togglebutton55_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton55 (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 togglebutton55
function edit19_Callback(hObject, eventdata, handles)
% hObject    handle to edit19 (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 edit19 as text
%        str2double(get(hObject,'String')) returns contents of edit19 as
a double

% --- Executes during object creation, after setting all properties.
function edit19_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit19 (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 RL.
function RL_Callback(hObject, eventdata, handles)
% hObject    handle to RL (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 RL

function ALF20_Callback(hObject, eventdata, handles)
% hObject    handle to ALF20 (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 ALF20 as text
%        str2double(get(hObject,'String')) returns contents of ALF20 as
a double

handles.ALF20=str2double(get(hObject,'string'));
if isnan(handles.ALF20)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function ALF20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to ALF20 (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 Vknee20_Callback(hObject, eventdata, handles)
% hObject    handle to Vknee20 (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 Vknee20 as text
%        str2double(get(hObject,'String')) returns contents of Vknee20
as a double
handles.Vknee20=str2double(get(hObject,'string'));
if isnan(handles.Vknee20)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function Vknee20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to Vknee20 (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 VA20_Callback(hObject, eventdata, handles)
% hObject    handle to VA20 (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 VA20 as text
%        str2double(get(hObject,'String')) returns contents of VA20 as a
double

handles.VA20=str2double(get(hObject,'string'));
if isnan(handles.VA20)
    errordlg('you must enter a numeric value','Error')
end
guidata(hObject,handles)

% --- Executes during object creation, after setting all properties.
function VA20_CreateFcn(hObject, eventdata, handles)
% hObject    handle to VA20 (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 togglebutton65.
function togglebutton65_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton65 (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 togglebutton65
% --- Executes on button press in togglebutton66.
function togglebutton66_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton66 (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 togglebutton66

% --- Executes on button press in togglebutton67.
function togglebutton67_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton67 (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 togglebutton67

% --- Executes on button press in togglebutton68.
function togglebutton68_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton68 (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 togglebutton68

% --- Executes on button press in togglebutton69.
function togglebutton69_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton69 (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 togglebutton69

% --- Executes on button press in togglebutton70.
function togglebutton70_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton70 (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 togglebutton70
% --- Executes on button press in togglebutton71.
function togglebutton71_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton71 (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 togglebutton71

% --- Executes on button press in togglebutton72.
function togglebutton72_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton72 (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 togglebutton72
% --- Executes on button press in togglebutton73.
function togglebutton73_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton73 (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 togglebutton73

% --- Executes on button press in togglebutton74.
function togglebutton74_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton74 (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 togglebutton74

% --- Executes on button press in togglebutton75.
function togglebutton75_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton75 (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 togglebutton75

% --- Executes on button press in togglebutton76.
function togglebutton76_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton76 (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 togglebutton76

% --- Executes on button press in togglebutton77.
function togglebutton77_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton77 (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 togglebutton77

% --- Executes on button press in togglebutton78.
function togglebutton78_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton78 (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 togglebutton78

% --- Executes on button press in togglebutton79.
function togglebutton79_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton79 (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 togglebutton79
% --- Executes on button press in togglebutton80.
function togglebutton80_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton80 (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 togglebutton80

% --- Executes on button press in togglebutton81.
function togglebutton81_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton81 (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 togglebutton81

% --- Executes on button press in togglebutton82.
function togglebutton82_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton82 (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 togglebutton82

% --- Executes on button press in togglebutton83.
function togglebutton83_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton83 (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 togglebutton83

% --- Executes on button press in togglebutton84.
function togglebutton84_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton84 (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 togglebutton84

% --- Executes on button press in togglebutton91.
function togglebutton91_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton91 (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 togglebutton91
```

```
% --- Executes on button press in togglebutton92.
function togglebutton92_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton92 (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 togglebutton92

% --- Executes on button press in togglebutton93.
function togglebutton93_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton93 (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 togglebutton93

% --- Executes on button press in togglebutton94.
function togglebutton94_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton94 (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 togglebutton94

% --- Executes on button press in togglebutton95.
function togglebutton95_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton95 (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 togglebutton95

% --- Executes on button press in togglebutton96.
function togglebutton96_Callback(hObject, eventdata, handles)
% hObject    handle to togglebutton96 (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 togglebutton96

% --- Executes on button press in pushbutton18.
function pushbutton18_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton18 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
SUM

% --- Executes on button press in pushbutton19.
function pushbutton19_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton19 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

x1=[0.0010 0.0020 0.0040 0.0050 0.0080 0.0100 0.0200 0.0400 0.0500
0.0800 0.1000 0.2000 0.4000 0.5000 0.8000 1.000]
y1=[39.3 77.5 204.0 287.0 507.8 622.9 797.0 859.6 870.1 887.8 895.6
919.4 943.8 951.1 965.4 972.7]
```

```
y2=[38.8 82.1 222.3 306.7 539.0 683.3 851.0 885.2 893.8 909.2 916.3
939.2 962.9 970.4 984.9 991.2]
y3=[30.3 72.7 226.7 317.5 549.8 674.2 851.8 886.9 895.3 910.7 917.8
940.5 963.6 970.2 983.8 990.2]
y4=[38.2 83.3 232.9 302.0 546.7 670.4 834.5 877.0 885.9 902.4 910.4
934.7 960.3 967.5 982.4 989.6]
y5=[36.3 81.6 214.2 297.3 534.4 661.6 848.4 888.8 897.0 911.6 919.0
942.4 966.7 974.2 989.0 995.7]
y6=[34.9 86.5 223.8 308.4 552.9 679.8 847.2 883.0 890.8 905.6 912.9
935.4 959.5 966.4 981.2 987.4]

figure
axes('FontSize',12)
loglog(x1,y1,'-
ro','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','g','MarkerS
ize',2)
hold on
loglog(x1,y2,'-
yo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','r','MarkerS
ize',2)
hold on
loglog(x1,y3,'-
bo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','w','MarkerS
ize',2)
hold on
loglog(x1,y4,'-
ro','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','c','MarkerS
ize',2)
hold on
loglog(x1,y5,'-
yo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','m','MarkerS
ize',2)
hold on
loglog(x1,y6,'-
bo','LineWidth',1.0,'MarkerEdgeColor','r','MarkerFaceColor','g','MarkerS
ize',2)
hold on
hold off
h = legend('CT4-Red Phase','CT4-Yellow Phase','CT4-Blue Phase','CT5-Red
Phase','CT5-Yellow Phase','CT5-Blue Phase');
grid on
xlabel({'Current in mA';'Current'})
ylabel({'Voltage in V';'Voltage'})
title('CT SATURATION PLOT','fontsize',15,'fontweight','b');
text(0.01,18,'ASA 10/50Vkp:CT4 R = 716.5 V; CT4 Y = 753.1V: CT4 B =
757.0V','FontSize',12,'fontweight','b')
text(0.01,15,'Vkp =
295.7V;291.25V;288.45V','FontSize',12,'fontweight','b')
text(0.01,13,'ASA 10/50Vkp:CT5 R = 743.7 V; CT5 Y = 750.8V: CT5 B =
748.3V','FontSize',12,'fontweight','b')
text(0.01,11,'Vkp =
295.7V;291.25V;288.45V','FontSize',12,'fontweight','b')
```