Contents

```matlab
function varargout = pvd_v4(varargin)
% CODE COMPILED BY ROSHAN R RAO
% PVD_V4 MATLAB code for pvd_v4.fig
%       PVD_V4, by itself, creates a new PVD_V4 or raises the existing
%       singleton*.
%
%       H = PVD_V4 returns the handle to a new PVD_V4 or the handle to
%       the existing singleton*.
%
%       PVD_V4('CALLBACK',hObject,eventData,handles,...) calls the local
%       function named CALLBACK in PVD_V4.M with the given input arguments.
%
%       PVD_V4('Property','Value',...) creates a new PVD_V4 or raises the
%       existing singleton*.  Starting from the left, property value pairs are
%       applied to the GUI before pvd_v4_OpeningFcn gets called.  An
%       unrecognized property name or invalid value makes property application
%       stop.  All inputs are passed to pvd_v4_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 pvd_v4

% Last Modified by GUIDE v2.5 15-May-2020 12:15:48

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @pvd_v4_OpeningFcn, ...
                   'gui_OutputFcn',  @pvd_v4_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 pvd_v4 is made visible.
function pvd_v4_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 pvd_v4 (see VARARGIN)

% Choose default command line output for pvd_v4
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% UIWAIT makes pvd_v4 wait for user response (see UIRESUME)
% uiwait(handles.figure1);


% --- Outputs from this function are returned to the command line.
function varargout = pvd_v4_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 start_load.
function start_load_Callback(hObject, eventdata, handles)
% hObject    handle to start_load (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
pause(1)
status1=('Loading.. please wait!');
set(handles.statusi,'string',status1);
pause(2)
global cz
global ag
```

```matlab
global celltech
global tabls1
global tabls2
global tabls3
global tabls4

global pc1
global pc2
global pc3
global pc11
global pc22
global pc33
global pc44

global rep1
global rep2
global rep3
global rep11
global rep22
global rep33
global rep44
global severty

cz=9999
ag=9999
celltech=9999



[tabls1(:,:,1),tabls2(:,:,1),tabls3(:,:,1),tabls4(:,:,1)]=a1_crack_snail_photo('Data_ver_1_visible_crack_snail_and_photobleach.xlsx');
[tabls1(:,:,2),tabls2(:,:,2),tabls3(:,:,2),tabls4(:,:,2)]=a2_snail_trail_framing('Data_ver_1_snail_tracks_framing.xlsx');
[tabls1(:,:,3),tabls2(:,:,3),tabls3(:,:,3),tabls4(:,:,3)]=a3_snail_tracks('Data_ver_1_snail_tracks.xlsx');
[tabls1(:,:,4),tabls2(:,:,4),tabls3(:,:,4),tabls4(:,:,4)]=a4_metall_discol('Data_ver_1_metall_discol.xlsx');
[tabls1(:,:,5),tabls2(:,:,5),tabls3(:,:,5),tabls4(:,:,5)]=a5_front_delam('Data_ver_1_front_delam.xlsx');
[tabls1(:,:,6),tabls2(:,:,6),tabls3(:,:,6),tabls4(:,:,6)]=a6_encap_discol('Data_ver_1_encap_discol.xlsx');
[tabls1(:,:,7),tabls2(:,:,7),tabls3(:,:,7),tabls4(:,:,7)]=a7_backsheet_degrad('Data_ver_1_backsh_degrad.xlsx');



[pc3,sm3,rep3]=c3_jbox('Data_ver_1_j_box_degrad.xlsx');
[pc2,sm2,rep2]=c2_glass_degrad('Data_ver_1_glass_degrad.xlsx');
[pc1,sm1,rep1]=c1_frame_degrad('Data_ver_1_frame_degrad.xlsx');


[pc33, sm33, rep33]=b3_a_Si('Data_ver_1_non_c_Si.xlsx');
[pc44, sm44, rep44]=b4_micromorph('Data_ver_1_non_c_Si.xlsx');
[pc11, sm11, rep11]=b1_CdTe('Data_ver_1_non_c_Si.xlsx');
[pc22, sm22, rep22]=b2_cigs('Data_ver_1_non_c_Si.xlsx');


severty=xlsread('SAFETY_PERFOR_MODE_to_SEVERITY_LIST.xlsx');
pause(0.5)
statu=('Done! proceed');
set(handles.statusi,'string',statu);


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


% --- Executes during object creation, after setting all properties.
function statusi_CreateFcn(hObject, eventdata, handles)
% hObject    handle to statusi (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 selection change in cell_tech_select.
function cell_tech_select_Callback(hObject, eventdata, handles)
% hObject    handle to cell_tech_select (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: contents = cellstr(get(hObject,'String')) returns cell_tech_select contents as cell array
%        contents{get(hObject,'Value')} returns selected item from cell_tech_select
global celltech

contents=cellstr(get(hObject,'String'));
pop_choice=contents(get(hObject,'Value'));

if(strcmp(pop_choice,'crystalline silicon'))
```

```matlab
    celltech=1
elseif(strcmp(pop_choice,'amorphous silicon'))
    celltech=2
elseif(strcmp(pop_choice,'micromorph silicon'))
    celltech=3
elseif(strcmp(pop_choice,'CdTe'))
    celltech=4
elseif(strcmp(pop_choice,'CIGS'))
    celltech=5
end


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

% Hint: popupmenu 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 next.
function next_Callback(hObject, eventdata, handles)
% hObject    handle to next (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)
global cz
global tabls1
global celltech
global ag
global pc1
global pc2
global pc3
global pc11
global pc22
global pc33
global pc44
global severty
global rep1
global rep2
global rep3
global rep11
global rep22
global rep33
global rep44

pause(1)
status1=('Loading.. please wait!');
set(handles.statusi,'string',status1);
pause(2)


if celltech==9999
    statu=('check cell technology');
    set(handles.statusi,'string',statu);
end

if cz==9999
    statu=('check climate zone');
    set(handles.statusi,'string',statu);
end

if ag==9999
    statu=('check age group');
    set(handles.statusi,'string',statu);
end

for gx=1:19
    if severty(gx,2)==1
        pe{gx,1}=['Rd <= 0.8% & Pm drop<=8%'];
    elseif severty(gx,2)==2
        pe{gx,1}=['Rd <= 0.8% & 8%<Pm drop<=20%'];
        elseif severty(gx,2)==3
        pe{gx,1}=['Rd > 0.8% & Pm drop<=20%'];
                elseif severty(gx,2)==4
        pe{gx,1}=['Rd > 0.8% & Pm drop>20%'];
                        elseif severty(gx,2)==5
        pe{gx,1}=['Rd > 0.8% & Pm drop>20%'];
    end
end



if celltech==1
```

```matlab
data(1:7,1)={'visible_crack_snail_and_photobleach','snail_tracks_framing','snail_tracks','metall_discol','front_delam','encap_discol','backsh_degr
data(8,1)=rep3(1);
data(8,2)=num2cell(pc3(1));
```

```matlab
data(9,1)=rep3(2);
data(9,2)=num2cell(pc3(2));

data(10,1)=rep3(3);
data(10,2)=num2cell(pc3(3));

data(11,1)=rep3(4);
data(11,2)=num2cell(pc3(4));

data(12,1)=rep3(7);
data(12,2)=num2cell(pc3(7));

data(13,1)=rep2(1);
data(13,2)=num2cell(pc2(1));

data(14,1)=rep2(5);
data(14,2)=num2cell(pc2(5));

data(15,1)=rep1(1);
data(15,2)=num2cell(pc1(1));

data(16,1)=rep1(2);
data(16,2)=num2cell(pc1(2));

data(17,1)=rep1(3);
data(17,2)=num2cell(pc1(3));

data(18,1)=rep1(4);
data(18,2)=num2cell(pc1(4));

data(19,1)=rep1(5);
data(19,2)=num2cell(pc1(5));

data(1:7,2)=num2cell(tabls1(cz,ag,:));

data(1:19,3)=pe;
prob_thesis=cell2mat(data(:,2));
% other degradationmodes %----------------------------
ncbns(1,1)=1;
ncbns(1,2)=0;
for r=1:18
cbns=combnk(2:19,r);
[rw cl]=size(cbns);
cbns1=[ones(rw,1) cbns];
cbns2=vertcat(ncbns,cbns1);
[rw2,cl2]=size(cbns2);
ncbns=[cbns2 zeros(rw2,1)];
end

ollcomb=ncbns(:,1:end-1);
ollcomb(ollcomb==0)=NaN;
[ou il]=size(ollcomb);


%for mode change here
for mode_nu=1:19

ollcomb=ollcomb+((mode_nu-1).*ones(ou,il));
for xx2=1:ou
    for yy2=1:il
    if ollcomb(xx2,yy2)>19
        ollcomb(xx2,yy2)=ollcomb(xx2,yy2)-19;
    end
    end
end
%for mode change here
% ollcomb;
%
% olla=reshape(ollcomb,[],1);
% hist(olla,19)

sev=ollcomb;
for xx=1:ou
    for yy=1:il
        if ollcomb(xx,yy)==1
            sev(xx,yy)=1;
        elseif ollcomb(xx,yy)==2
            sev(xx,yy)=1;
        elseif ollcomb(xx,yy)==3
            sev(xx,yy)=1;
        elseif ollcomb(xx,yy)==4
            sev(xx,yy)=3;
        elseif ollcomb(xx,yy)==5
            sev(xx,yy)=1;
        elseif ollcomb(xx,yy)==6
            sev(xx,yy)=3;
        elseif ollcomb(xx,yy)==7
            sev(xx,yy)=3;
        elseif ollcomb(xx,yy)==8
            sev(xx,yy)=2;
        elseif ollcomb(xx,yy)==9
            sev(xx,yy)=3;
        elseif ollcomb(xx,yy)==10
```

```matlab
                sev(xx,yy)=4;                         % 5 has been changed to 4
            elseif ollcomb(xx,yy)==11
                sev(xx,yy)=1;
            elseif ollcomb(xx,yy)==12
                sev(xx,yy)=3;
            elseif ollcomb(xx,yy)==13
                sev(xx,yy)=4;                         % 5 has been changed to 4
            elseif ollcomb(xx,yy)==14
                sev(xx,yy)=2;
            elseif ollcomb(xx,yy)==15
                sev(xx,yy)=1;
            elseif ollcomb(xx,yy)==16
                sev(xx,yy)=1;
            elseif ollcomb(xx,yy)==17
                sev(xx,yy)=1;
            elseif ollcomb(xx,yy)==18
                sev(xx,yy)=4;                         % 5 has been changed to 4
            elseif ollcomb(xx,yy)==19
                sev(xx,yy)=4;                         % 5 has been changed to 4
            end
        end
    end
end

 sevi=reshape(sev(:,2:end),[],1);
% sevi=reshape(sev,[],1);
[ajg jk]=size(sev);
samplespace=((ajg.*jk)-length(find(isnan(sev))))-ajg;

% hist(sevi,4)

one=(histc(sevi,1)./samplespace).*100;
two=(histc(sevi,2)./samplespace).*100;
three=(histc(sevi,3)./samplespace).*100;
four=(histc(sevi,4)./samplespace).*100;
fractos(mode_nu,:)=[one two three four];

end
```

for thesis extra calculation

```matlab
fractos_thes=nanmean(fractos,1)
prob_av_1=nanmean([prob_thesis(1) prob_thesis(2) prob_thesis(3) prob_thesis(5) prob_thesis(11) prob_thesis(15) prob_thesis(16) prob_thesis(17)])
prob_av_2=nanmean([prob_thesis(8) prob_thesis(9) prob_thesis(14)])
prob_av_3=nanmean([prob_thesis(4) prob_thesis(6) prob_thesis(7) prob_thesis(12)])
prob_av_4=nanmean([prob_thesis(10) prob_thesis(13) prob_thesis(18) prob_thesis(19)])

req_prob_thes=(vertcat(fractos_thes,[prob_av_1 prob_av_2 prob_av_3 prob_av_4]))
req_prob_thesis=nanmean(req_prob_thes,1)
% for thesis extra calculation over
fractos=num2cell(fractos);
% other degradationmodes %----------------------------
set(handles.tabl1,'data', data);
set(handles.tabl2,'data',fractos);

pause(0.5)
statu=('Ready');
set(handles.statusi,'string',statu);
```

```matlab
end

      if celltech==2
data(1:5,1)=rep33;
data(1:5,2)=num2cell(pc33);

fractos={};
set(handles.tabl2,'data',fractos);

set(handles.tabl1,'data', data);
pause(0.5)
statu=('Ready');
set(handles.statusi,'string',statu);
      end

      if celltech==3
data(1:5,1)=rep44;
data(1:5,2)=num2cell(pc44);
fractos={};
set(handles.tabl2,'data',fractos);
set(handles.tabl1,'data', data);
pause(0.5)
statu=('Ready');
set(handles.statusi,'string',statu);
      end

      if celltech==4
data(1:5,1)=rep11;
data(1:5,2)=num2cell(pc11);
fractos={};
set(handles.tabl2,'data',fractos);
set(handles.tabl1,'data', data);
```

```matlab
    pause(0.5)
    statu=('Ready');
    set(handles.statusi,'string',statu);
          end

          if celltech==5
    data(1:5,1)=rep22;
    data(1:5,2)=num2cell(pc22);
    fractos={};
    set(handles.tabl2,'data',fractos);
    set(handles.tabl1,'data', data);
    pause(0.5)
    statu=('Ready');
    set(handles.statusi,'string',statu);

          end

% --- Executes on selection change in cz_select.
function cz_select_Callback(hObject, eventdata, handles)
% hObject    handle to cz_select (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: contents = cellstr(get(hObject,'String')) returns cz_select contents as cell array
%        contents{get(hObject,'Value')} returns selected item from cz_select
global cz

contents=cellstr(get(hObject,'String'));
pop_choice=contents(get(hObject,'Value'));

 if(strcmp(pop_choice,'warm and humid'))
      cz=1
 elseif(strcmp(pop_choice,'Select Climate Zone'))
      cz=0
 elseif(strcmp(pop_choice,'hot and dry'))
      cz=2
 elseif(strcmp(pop_choice,'composite'))
      cz=3
 elseif(strcmp(pop_choice,'moderate'))
      cz=4
 elseif(strcmp(pop_choice,'cold and sunny'))
      cz=5
 elseif(strcmp(pop_choice,'cold and cloudy'))
      cz=6
 end

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

% Hint: popupmenu 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 selection change in age_grp.
function age_grp_Callback(hObject, eventdata, handles)
% hObject    handle to age_grp (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: contents = cellstr(get(hObject,'String')) returns age_grp contents as cell array
%        contents{get(hObject,'Value')} returns selected item from age_grp
global ag

contents=cellstr(get(hObject,'String'));
pop_choice=contents(get(hObject,'Value'));

 if(strcmp(pop_choice,'0 - 5 years'))
      ag=1

 elseif(strcmp(pop_choice,'5 - 10 years'))
      ag=2

 elseif(strcmp(pop_choice,'Select PV age group'))
      ag=0
 elseif(strcmp(pop_choice,'10 - 20 years'))
      ag=3

 elseif(strcmp(pop_choice,'20 years above'))
      ag=4

end

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

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


% --- Executes when entered data in editable cell(s) in uitable2.
function uitable2_CellEditCallback(hObject, eventdata, handles)
% hObject    handle to uitable2 (see GCBO)
% eventdata  structure with the following fields (see UITABLE)
%       Indices: row and column indices of the cell(s) edited
%       PreviousData: previous data for the cell(s) edited
%       EditData: string(s) entered by the user
%       NewData: EditData or its converted form set on the Data property. Empty if Data was not changed
%       Error: error string when failed to convert EditData to appropriate value for Data
% handles    structure with handles and user data (see GUIDATA)


% --- Executes when selected cell(s) is changed in uitable2.
function uitable2_CellSelectionCallback(hObject, eventdata, handles)
% hObject    handle to uitable2 (see GCBO)
% eventdata  structure with the following fields (see UITABLE)
%       Indices: row and column indices of the cell(s) currently selecteds
% handles    structure with handles and user data (see GUIDATA)
```

pvd_v4

Start (load files)

Welcome. Click Start

Select cell techn... ⌄

Crystalline Silicon Panel

Select Clima... ⌄

Select PV ag... ⌄

NEXT

DEGRADATION MODES

Probability of performance losses due

	Degradation mode	Probability	performance effect
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			

	Rd <= 0.8%
1	
2	
3	
4	