

MATLAB EXERCISE 1.25 GUI for different coordinate conversions. Create a graphical user interface (GUI) in MATLAB that combines the functions for different coordinate conversions written in the previous MATLAB exercise, as well as the corresponding functions to convert cylindrical to spherical coordinates of a point and vice versa [functions `cyl2Sph()` and `sph2Cyl()`]. The user should be able to specify the type of conversion, enter input data, and run the function, upon which the program displays results. All angles at input and output are in degrees. *[folder ME1_25(GUI) on IR]*

SOLUTION:

We build an interface – using the existing MATLAB GUI. See the TUTORIAL (in the book, Chapter 2) for MATLAB Exercise 2.1 – for the GUI development.

Figure S1.15 shows the layout of the GUI.

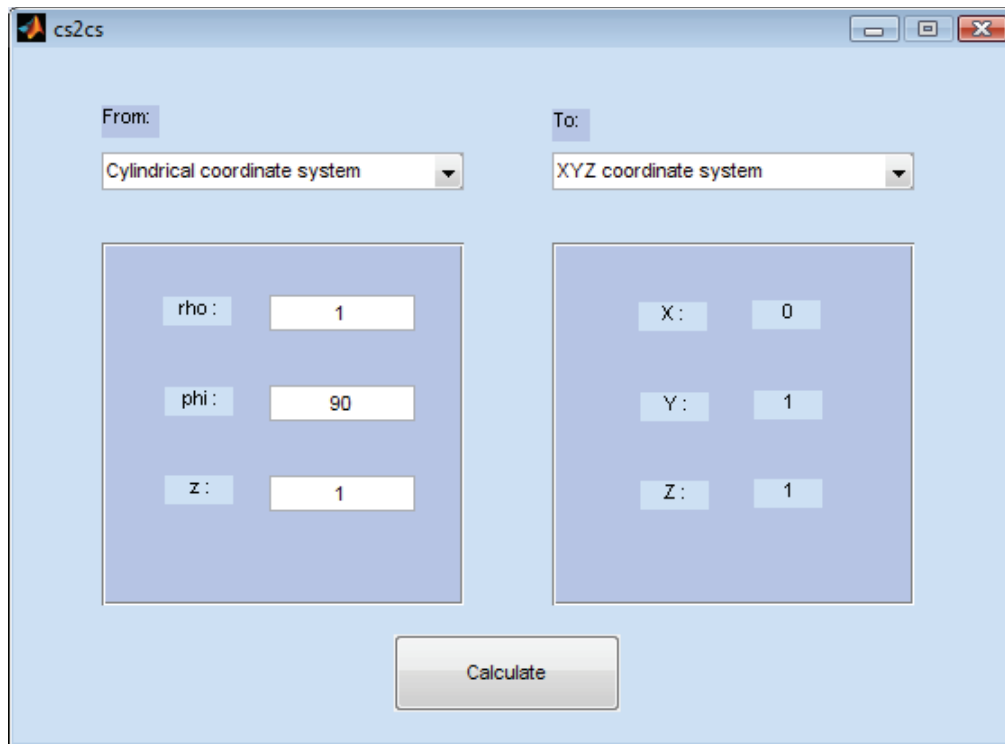


Figure S1.15 MATLAB graphical user interface for different coordinate conversions: GUI in the case conversion from cylindrical to Cartesian coordinates of a point is selected in the pop-up menu; for MATLAB Exercise 1.25.

```
%
% Book: MATLAB-Based Electromagnetics (Pearson Prentice Hall)
% Author: Branislav M. Notaros
% Instructor Resources
% (c) 2011
%
% This MATLAB code or any part of it may be used only for
% educational purposes associated with the book
%
%
%
% GUI for different coordinate conversions

function varargout = cs2cs(varargin)
% CS2CS M-file for cs2cs.fig
% CS2CS, by itself, creates a new CS2CS or raises the existing
% singleton*.
%
% H = CS2CS returns the handle to a new CS2CS or the handle to
% the existing singleton*.
%
% CS2CS('CALLBACK',hObject,eventData,handles,...) calls the local
% function named CALLBACK in CS2CS.M with the given input arguments.
%
% CS2CS('Property','Value',...) creates a new CS2CS or raises the
% existing singleton*. Starting from the left, property value pairs are
% applied to the GUI before cs2cs_OpeningFcn gets called. An
% unrecognized property name or invalid value makes property application
% stop. All inputs are passed to cs2cs_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 cs2cs

% Last Modified by GUIDE v2.5 28-May-2010 15:06:05

% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name', mfilename, ...
    'gui_Singleton', gui_Singleton, ...
    'gui_OpeningFcn', @cs2cs_OpeningFcn, ...
    'gui_OutputFcn', @cs2cs_OutputFcn, ...
    'gui_LayoutFcn', [] , ...
    'gui_Callback', []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
```

```
end

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

% --- Executes just before cs2cs is made visible.
function cs2cs_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 cs2cs (see VARARGIN)

% Choose default command line output for cs2cs
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

set(0, 'units', 'inches');
screensize = get(0, 'screensize');
set(hObject, 'units', 'inches', 'Position', [screensize(3)/2-(5.75/2), screensize(4)/2-(3.9375
/2), 5.75, 3.9375]);

% UIWAIT makes cs2cs wait for user response (see UIRESUME)
% uiwait(handles.figure1);

% --- Outputs from this function are returned to the command line.
function varargout = cs2cs_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 selection change in popupmenu2.
function popupmenu2_Callback(hObject, eventdata, handles)
% hObject    handle to popupmenu2 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: contents = get(hObject, 'String') returns popupmenu2 contents as cell array
```

```

%         contents{get(hObject,'Value')} returns selected item from
%         popupmenu2
switch get(handles.popupmenu2,'Value')
    case 1
        set(handles.popupmenu4,'String',{'Spherical coordinate system'; 'Cylindrical
coordinate system'});
        set(handles.text4,'String','X :');
        set(handles.text15,'String','Y :');
        set(handles.text16,'String','Z :');
    case 2
        set(handles.popupmenu4,'String',{'XYZ coordinate system'; 'Cylindrical coordinate
system'});
        set(handles.text4,'String','r :');
        set(handles.text15,'String','theta:');
        set(handles.text16,'String','phi:');
    case 3
        set(handles.popupmenu4,'String',{'XYZ coordinate system'; 'Spherical coordinate
system'});
        set(handles.text4,'String','rho :');
        set(handles.text15,'String','phi :');
        set(handles.text16,'String','z :');
    otherwise
end
set(handles.uipanel1,'Visible','on');
set(handles.uipanel2,'Visible','off');
global ready;
ready = [0 0 0];
global var;
var = [0 0 0];
set(handles.pushbutton1,'Enable','off');
set(handles.edit1,'String','');
set(handles.edit2,'String','');
set(handles.edit3,'String','');

% --- Executes during object creation, after setting all properties.
function popupmenu2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to popupmenu2 (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;
global ready;
ready = [0 0 0];
global var;
var = [0 0 0];

```

```

% --- 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)
global var;
m = get(handles.popupmenu2, 'Value');
n = get(handles.popupmenu4, 'Value');
[s1 s2 s3] = fromCS2CS(var, m ,n );
set(handles.text20, 'String', num2str(s1));
set(handles.text21, 'String', num2str(s2));
set(handles.text22, 'String', num2str(s3));

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
x = str2double(get(hObject, 'String'));
global ready;
global var;
if (isnan(x));
    msgbox('Invalid input', 'Error');
    ready(1)= 0;
else
    ready(1)= 1;
    var(1) = x;
end;
if (ready == [1 1 1])
    set(handles.pushbutton1, 'Enable', 'on');
else
    set(handles.pushbutton1, 'Enable', 'off');
end;

% --- 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 edit2_Callback(hObject, eventdata, handles)
% hObject    handle to edit2 (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 edit2 as text
%        str2double(get(hObject,'String')) returns contents of edit2 as a double
x = str2double(get(hObject,'String'));
global ready;
global var;
if (isnan(x));
    msgbox('Invalid input','Error');
    ready(2)= 0;
else
    ready(2)= 1;
    var(2) = x;
end;
if (ready == [1 1 1])
    set(handles.pushbutton1,'Enable','on');
else
    set(handles.pushbutton1,'Enable','off');
end;

% --- Executes during object creation, after setting all properties.
function edit2_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit2 (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 edit3_Callback(hObject, eventdata, handles)
% hObject    handle to edit3 (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 edit3 as text
%        str2double(get(hObject,'String')) returns contents of edit3 as a double
x = str2double(get(hObject,'String'));
global ready;
global var;
if (isnan(x));

```

```

    msgbox('Invalid input','Error');
    ready(3)= 0;
else
    ready(3)= 1;
    var(3) = x;
end;
if (ready == [1 1 1])
    set(handles.pushbutton1,'Enable','on');
else
    set(handles.pushbutton1,'Enable','off');
end;

% --- Executes during object creation, after setting all properties.
function edit3_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit3 (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 popupmenu4.
function popupmenu4_Callback(hObject, eventdata, handles)
% hObject    handle to popupmenu4 (see GCBO)
% eventdata  reserved - to be defined in a future version of MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Hints: contents = get(hObject,'String') returns popupmenu4 contents as cell array
%         contents{get(hObject,'Value')} returns selected item from
%         popupmenu4
set(handles.uipanel2,'Visible','on');
set(handles.pushbutton1,'Visible','on');
switch get(handles.popupmenu2,'Value')
    case 1
        switch get(handles.popupmenu4,'Value')
            case 1
                set(handles.text17,'String','r :');
                set(handles.text18,'String','theta:');
                set(handles.text19,'String','phi:');
            case 2
                set(handles.text17,'String','rho :');
                set(handles.text18,'String','phi :');
                set(handles.text19,'String','z :');
        end;
    case 2
        switch get(handles.popupmenu4,'Value')

```

```

        case 1
            set(handles.text17,'String','X :');
            set(handles.text18,'String','Y :');
            set(handles.text19,'String','Z :');
        case 2
            set(handles.text17,'String','rho :');
            set(handles.text18,'String','phi :');
            set(handles.text19,'String','z :');
    end;
case 3
    switch get(handles.popupmenu4,'Value')
        case 1
            set(handles.text17,'String','X :');
            set(handles.text18,'String','Y :');
            set(handles.text19,'String','Z :');
        case 2
            set(handles.text17,'String','r :');
            set(handles.text18,'String','theta:');
            set(handles.text19,'String','phi:');
    end;
end;
global ready;
ready = [0 0 0];
global var;
var = [0 0 0];
set(handles.pushbutton1,'Enable','off');
set(handles.text20,'String','');
set(handles.text21,'String','');
set(handles.text22,'String','');
set(handles.edit1,'String','');
set(handles.edit2,'String','');
set(handles.edit3,'String','');

% --- Executes during object creation, after setting all properties.
function popupmenu4_CreateFcn(hObject, eventdata, handles)
% hObject    handle to popupmenu4 (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

function [s1 s2 s3] = fromCS2CS(var,m,n)

```



```
switch m
    case 1
        switch n
            case 1
                [s1 s2 s3] = car2Sph(var(1),var(2),var(3));
                s2 = s2 * 180/pi;
                s3 = s3 * 180/pi;
            case 2
                [s1 s2 s3] = car2Cyl(var(1),var(2),var(3));
                s2 = s2 * 180/pi;
        end;
    case 2
        var(2) = var(2)*pi/180;
        var(3) = var(3)*pi/180;
        switch n
            case 1
                [s1 s2 s3] = sph2Car(var(1),var(2),var(3));
            case 2
                [s1 s2 s3] = sph2Cyl(var(1),var(2),var(3));
                s2 = s2 * 180/pi;
        end;
    case 3
        var(2) = var(2)*pi/180;
        switch n
            case 1
                [s1 s2 s3] = cyl2Car(var(1),var(2),var(3));
            case 2
                [s1 s2 s3] = cyl2Sph(var(1),var(2),var(3));
                s2 = s2 * 180/pi;
                s3 = s3 * 180/pi;
        end;

end;
if (s1<0.00001)
    s1 = 0;
end;
if (s2<0.00001)
    s2 = 0;
end;
if (s3<0.00001)
    s3 = 0;
end;
```

```
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%  
%  
%
```

```
function [R,THETA,PHI] = cyl2Sph(r,phi,z)  
R = sqrt(r^2 + z^2);  
THETA = atan(r/z);  
PHI = phi;
```

```
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%
```

```
function [R,PHI,Z] = sph2Cyl(r,theta,phi)  
R = r*sin(theta);  
PHI = phi;  
Z = r*cos(theta);
```