

MATLAB EXERCISE 2.7 **Horizontal boundary plane with surface charge.** Repeat the previous MATLAB exercise but for a horizontal boundary plane with free surface charge ($\rho_s \neq 0$). (*ME2-7.m on IR*)

SOLUTION:

```

%
% 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
%
%
% Dielectric - dielectric boundary conditions - Horizontal boundary plane
% with surface charge

clear all;
close all;
EPS0 = 8.8542*10^(-12);

NORMAL = [0,0,1];

% Electric field vector
Ex1 = input('Enter x-component of E-field in medium 1, in V/m: ');
Ey1 = input('Enter y-component of E-field in medium 1, in V/m: ');
Ez1 = input('Enter z-component of E-field in medium 1, in V/m: ');
% Surface charge density
RHOS = input('Enter the surface charge density in pC/m^2: ');
RHOS = RHOS*10^(-12);
% Dielectrics
EPSR1 = input('Enter the relative permittivity of medium 1: ');
EPSR2 = input('Enter the relative permittivity of medium 2: ');

Emag = sqrt(Ex1^2 + Ey1^2 + Ez1^2);
E1 = [Ex1,Ey1,Ez1];

Elnormal = Ez1.*NORMAL;
Eltangential = E1 - Elnormal;

E2normal = (Elnormal.*EPSR1*EPS0 - RHOS.*NORMAL)/(EPSR2*EPS0);
E2tangential = Eltangential;
E2 = E2normal + E2tangential;

disp('E-field in medium 2, in V/m, is:');
fprintf('%f)*ux',E2(1));
fprintf(' + (%f)*uy',E2(2));
fprintf(' + (%f)*uz\n',E2(3));

A = [abs(E1(1)),abs(E1(2)),abs(E1(3)),abs(E2(1)),abs(E2(2)),abs(E2(3)),1];
B = max(A) + 0.1;

figure(1);
[x,y] = meshgrid(-B:B/4:B,-B:B/4:B);

```

```
Bz = NORMAL(1)*x + NORMAL(2)*y;  
h = surf(x,y,Bz);axis equal; hold on;  
colormap (white);  
plot3(0,0,0,'ko','MarkerFaceColor','k'); hold on;  
quiver3(0,0,0,NORMAL(1),NORMAL(2),NORMAL(3),0,'r','LineWidth',2);  
text (0,0,1/2,'n');  
quiver3(0,0,0,E1(1),E1(2),E1(3),0,'b','LineWidth',2);  
text (E1(1)/2,E1(2)/2,E1(3)/2,'E1');  
quiver3(0,0,0,E2(1),E2(2),E2(3),0,'g','LineWidth',2);  
text (E2(1)/2,E2(2)/2,E2(3)/2,'E2');  
xlabel('x [m]'); ylabel('y [m]'); zlabel('z [m]');
```