MATLAB EXERCISE 1.44 **Field computation in plate and cube problems.** Using function `fieldE` (written in the previous MATLAB exercise), as well as programs from MATLAB Exercises 1.39 and 1.41, compute (i) the electric field along the axis of the plate from MATLAB Exercise 1.39 perpendicular to its plane at points that are $a/2$, $2a$, and $100a$, respectively, distant from the plate surface (for $N = 100$) and (ii) the field inside the cube from MATLAB Exercise 1.41, at a quarter of its space diagonal (body diagonal) and at its center. *(ME1_44.m on IR)*

SOLUTION:

The computed electric field intensity along the axis of the plate (from MATLAB Exercise 1.39) perpendicular to its plane at points that are $a/2$, $2a$, and $100a$ distant from the plate surface (for $N = 100$) amounts to $E = 635.5$ mV/m, $E = 82.8$ mV/m, and $E = 35.77$ μV/m, respectively, with the vector $\mathbf{E}$ being along the axis.

For the Cartesian coordinate system adopted as in Fig.S1.1 (or Fig.1.2 from the book), the electric field vector inside the cube (from MATLAB Exercise 1.41), at a quarter of its space diagonal (body diagonal) – point defined by $x = y = z = a/4$, is obtained to be $\mathbf{E} = 2\,(\hat{\mathbf{x}} + \hat{\mathbf{y}} + \hat{\mathbf{z}})$ mV/m [$E = 3.464$ mV/m and the unit vector of $\mathbf{E}$ is $0.5773\,(\hat{\mathbf{x}} + \hat{\mathbf{y}} + \hat{\mathbf{z}})$], while $\mathbf{E} = 0$ at the cube center.

```
%
%   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
%
%
%


%   Field computation in plate and cube problems


clear all;
close all;
N = 100;  %total number of patches
a = 1;
V0 = 1;
EPS0 = 8.8542*10^(-12);
n = sqrt(N);

%coordinates of centers of patches

[x,y,S] = localCoordinates(n,n,a,a);

%matrix A

A = matrixA(EPS0,S,x,y);

%matrix B

B = V0*ones(1,N)';  %transpose

rhos = A\B;  %solving the equation

%field
d = [a/2,2*a,100*a];

 fprintf('\nField values:');
for i=1:length(d)
    [E,unitE,Emag] = fieldE(EPS0,a/2,a/2,d(i),rhos,S,x,y);
    fprintf('\n %f [%.2f %.2f %.2f] V/m',Emag,unitE);
end;

%%
clear all;
close all;
N = 600;
Nside = N/6;
```

```
a = 1;
V0 = 1;
EPS0 = 8.8542*10^(-12);
n = sqrt(Nside);

[p,q,dS] = localCoordinates(n,n,a,a);
temp0 = zeros(1,Nside);
temp1 = a*ones (1,Nside);


x = [p,p,p,p,temp0,temp1];
y = [q,q,temp0,temp1,p,p];
z = [temp0,temp1,q,q,q,q];
S = [dS,dS,dS,dS,dS,dS];


%matrix A
A = matrixA(EPS0,S,x,y,z);

%matrix B

B = V0 * ones(N,1);  %transpose

rhos = A\B;  %solving the equation

d = [a/4,a/2];

%field
fprintf('\nField values:');
for i=1:length(d)
    [E,unitE,Emag] = fieldE(EPS0,d(i),d(i),d(i),rhos,S,x,y,z);
     fprintf('\n %f [%.2f %.2f %.2f] V/m',Emag,unitE);
end;
```