

MATLAB EXERCISE 1.14 Visualization of the electric field due to four point charges. With the use of MATLAB function `quiver`, visualize the total electric field vector due to four equal point charges Q placed at vertices of a square of edge length a in free space. (*ME1_14.m on IR*)

SOLUTION:

See the TUTORIAL (in the book) to the previous MATLAB exercise. The result is displayed in Fig.S1.9.

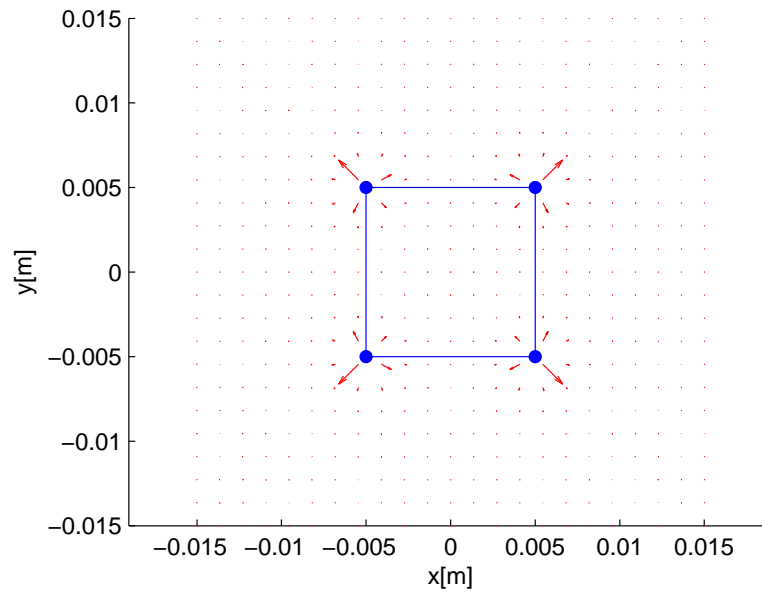


Figure S1.9 Visualization of the total electric field due to four point charges at square vertices ($Q = 1$ nC and $a = 1$ cm) using MATLAB function `quiver`; for MATLAB Exercise 1.14.

```
%
% 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
%
%
%
```

```
% Visualization of the electric field due to four point charges
```

```
clear all;
close all;

EPS0 = 8.8542 * 10^(-12);
a = input('Dimension of a square at the origin in cm: ');
a = a*10^(-2);
Q = input('Charge placed at each corner of a square in nC: ');
Q = Q *10^(-9);
v = -1.5*a: 1.5/11*a : 1.5*a;
[x,y] = meshgrid(v);
N = length(x);
temp = a/2 * ones(N,N);
xsquare = [temp temp -temp -temp];
ysquare = [temp -temp temp -temp];
xtot = [x x x x];
ytot = [y y y y];
rx = (xtot - xsquare);
ry = (ytot - ysquare);
rMag = sqrt (rx.^2 + ry.^2);
rxUnit = (xtot - xsquare)./rMag;
ryUnit = (ytot - ysquare)./rMag;
Qtot = Q*ones(N,4*N);
Emag = Qtot./(4*EPS0*rMag.^2);
Ex = Emag.*rxUnit;
Ey = Emag.*ryUnit;
Etotx(:, :) = Ex(:,1:N)+Ex(:,N+1:2*N)+Ex(:,2*N+1:3*N)+Ex(:,3*N+1:4*N);
Etoty(:, :) = Ey(:,1:N)+Ey(:,N+1:2*N)+Ey(:,2*N+1:3*N)+Ey(:,3*N+1:4*N);
line([-a/2 a/2],[a/2 a/2]);
hold on;
line([a/2 a/2],[-a/2 a/2]);
line([-a/2 a/2],[-a/2 -a/2]);
line([-a/2 -a/2],[a/2 -a/2]);
plot(a/2,a/2,'bo','MarkerSize',5,'MarkerFaceColor','b');
plot(-a/2,a/2,'bo','MarkerSize',5,'MarkerFaceColor','b');
plot(a/2,-a/2,'bo','MarkerSize',5,'MarkerFaceColor','b');
plot(-a/2,-a/2,'bo','MarkerSize',5,'MarkerFaceColor','b');
```

```
quiver(v,v,Etotx,Etoty,'r');  
hold off;  
axis equal;  
xlabel('x[m]');  
ylabel('y[m]');
```