Experiment : 7

Name : Vishal Anand
Roll Code : 19/367
Subject : Electromagnetics
Course : B.Sc. Hons. Electronics
Semester : 5th

Experiment : 7

Aim : Programs and Contour Plots to illustrate Method of Images.

Apparatus Required : A desktop with Scilab installed in it.

Theory :

The image theory states that a given charge configuration above an infinite grounded perfect conducting plane may be replaced by the charge configuration itself, its image and an equipotential surface in place of the conducting plane. The electric field at a point P(x,y,z)

$$E = E_+ + E_-$$

$$E = \frac{Q\ r_1}{4\pi\varepsilon_0 r_1^3} + \frac{-Q r_2}{4\pi\varepsilon_0 r_2^3}$$

Potential P can be obtained by :

$$V = V_+ + V_-$$

$$V = \frac{Q}{4\pi\varepsilon_0 r_1} + \frac{-Q}{4\pi\varepsilon_0 r_2}$$

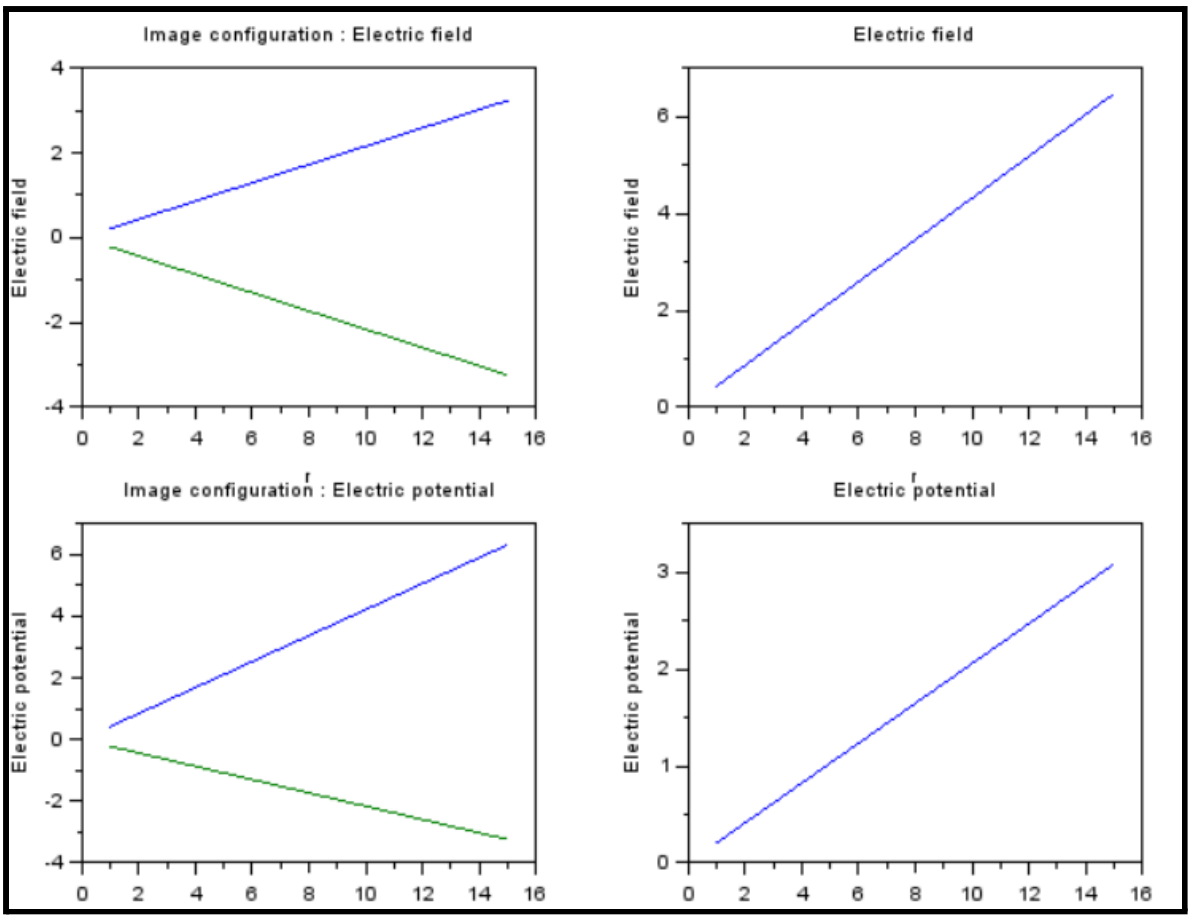
Code :

Expt-7-contour plots-Vishal-Anand.sce

```
// Method of image Electric field
Q=3*10^-9;
r=1:15;
r1=5;
r2=5;
d1=Q*r*((r1^3)^-1);
d2=-1*Q*r*((r2^3)^-1);
k=9*10^9;
e1=d1*k;
e2=d2*k;
```

```
e=e1-e2;
subplot(221);
plot(r,e1,r,e2);
title("Image configuration : Electric field");
xlabel("r");
ylabel("Electric field");
subplot(222);
plot(r,e);
title("Electric field");
xlabel("r");
ylabel("Electric field ");
// Method of image Electric potential
Q=3*10^-9;
r=1:15;
r1=4;
r2=5;
d1=Q*r*((r1^3)^-1);
d2=-1*Q*r*((r2^3)^-1);
k=9*10^9;
v1=d1*k;
v2=d2*k;
v=v1+v2;
subplot(223);
plot(r,v1,r,v2);
title("Image configuration : Electric potential");
xlabel("r");
ylabel("Electric potential");
subplot(224);
plot(r,v);
title("Electric potential");
xlabel("r");
ylabel("Electric potential ")
```

Output :



Result : Contour plots to illustrate Method of Images were plotted successfully using Scilab software.

Discussion : While applying the Method of Images, the following two conditions must always be satisfied:

1. The image charge must be located in the conducting region.
2. The image charge must be located such that on the conducting surfaces the potential is zero or constant.
   Condition 1 is necessary to satisfy Poisson's equation and condition 2 ensures that the boundary conditions are satisfied