

Exercise 9:

Using **Method of image charges**, find the distribution of electric field $\vec{E}(\vec{r})$ and charge density $\sigma(\vec{r})$ on the surface for the following cases:

1. A point charge $+q$ is placed in front of PEC infinite wall at distance h , Fig. 1.a.
2. A point charge $+q$ is placed in front of PEC corner at distance h , Fig. 1.b
3. A point charge $+q$ is placed in front of PEC sphere with radius r , Fig. 1.c

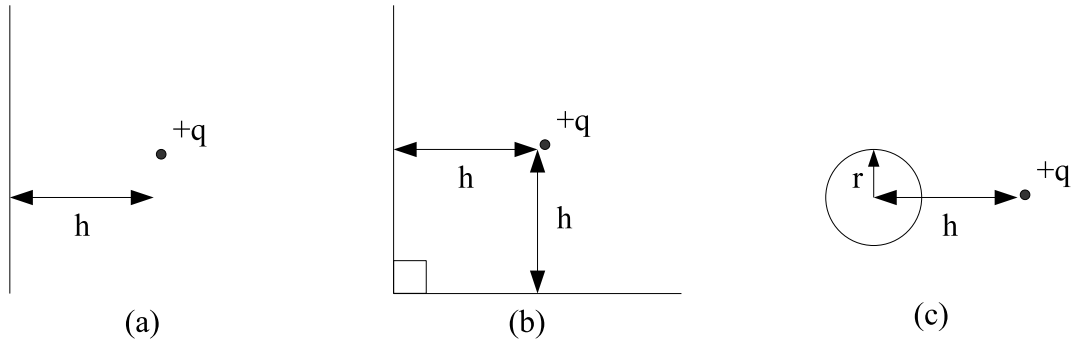


Figure 1: Locations of the point sources.

Use COMSOL to analyze 2D cases of the problems above.

Exercise 10:

In the simulation of scattering from an obstacle, Perfectly Matched Layers (PMLs) are very important, since they cancel out any reflections from the boundary of the numerical domain. In this exercise, we will use PMLs in Comsol to obtain the scattered field from a cylinder with the specifications given in Fig. The free-space wavelength of the incident field is taken to be $\lambda_0 = 1m$.

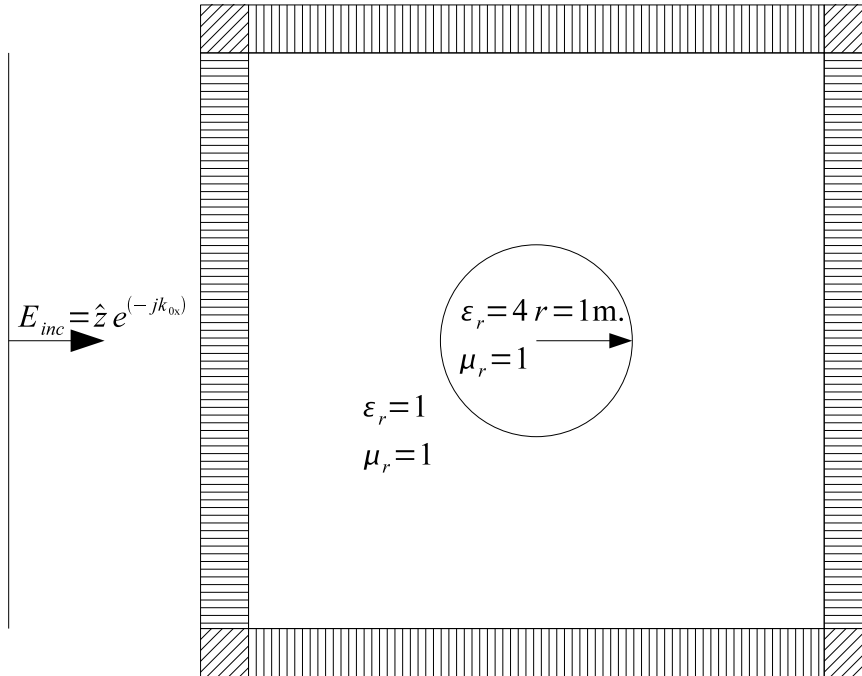


Figure 2: The geometry to be solved. The shaded regions are PMLs with the directions given by the lines. The incident field is a TE-mode plane wave propagating in the positive x direction. ($e^{j\omega t}$ time convention is used.)

- Try different meshes and PML thicknesses to analyze the results. What order of mesh size is needed to obtain correct results?
- Use the Matlab Code provided (Click to download) to analyze the solution of Comsol with the analytical solution.