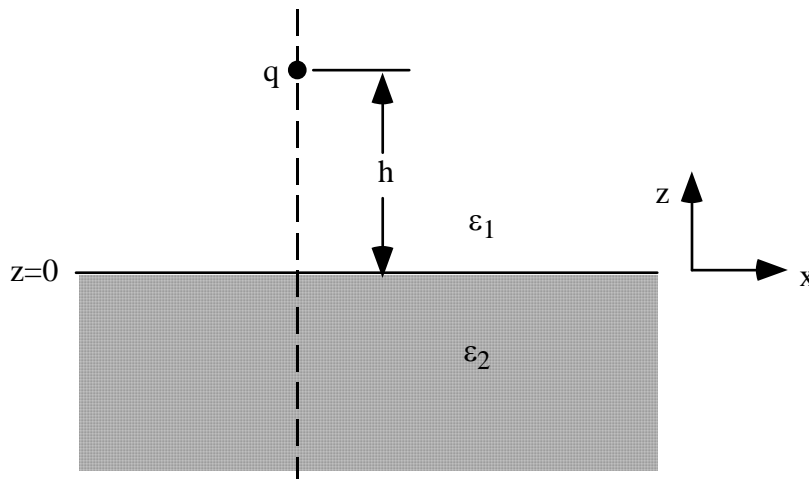


ECE 546 HOMEWORK No 1 Due Wednesday, February 3, 2016



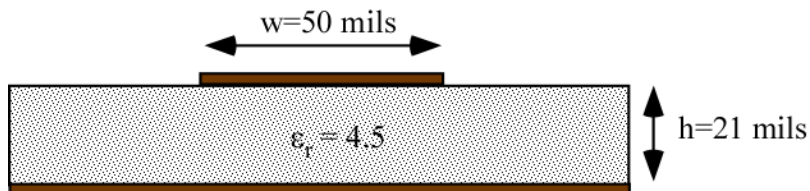
Problem 1

1. In the calculation of capacitance coefficient for complex interconnect structures, it is often desired to determine the 3D Green's function for the electrostatic potential. The Green's function is the potential due to a point source as observed at a specific location.

Consider a point charge q located in medium 1 at a height h away from a flat boundary of medium 2 as illustrated above. Medium 1 and 2 are characterized by permittivities ϵ_1 and ϵ_2 respectively.

- (a) Find the electrostatic potential measured by an observer $P_1(x, y, z)$ located in medium 1.
- (b) Find the electrostatic potential measured by an observer $P_2(x, y, z)$ located in medium 2.

2. Consider a microstrip line with width 50 mils and dielectric height 21 mils. Since the strip is relatively wide, you can ignore the fringing fields and model the microstrip as a parallel metal plate waveguide. The dielectric is of FR4 material ($\epsilon_r = 4.5$).



Problem 2

- (a) What is the highest order mode that can propagate in the microstrip at a frequency of

- i) 50 GHz
- ii) 150 GHz

(b) What is the phase velocity of the lowest order propagating mode at

- i) 50 GHz
- ii) 150 GHz

(c) What is the phase velocity, of the highest order propagating mode at

- i) 50 GHz
- ii) 150 GHz

(d) From your analysis, what is the bandwidth of the microstrip line?