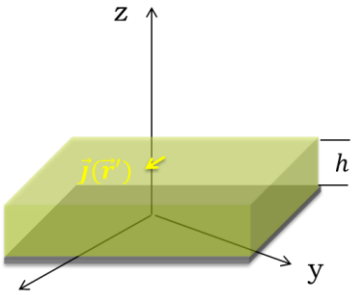
EE4620 - Spectral Methods in Electromagnetics (2022-2023)

MATLAB 1: Spectral Green's Function for Stratified Media

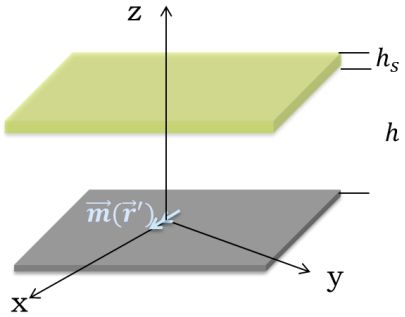
Question 1 (3 points):



Write a MATLAB routine to calculate the spectral Green's function for the electric field given an elementary electric source placed at the top of a grounded slab of thickness h and dielectric constant ε_r as shown in the figure. Consider $h = 4.5\text{mm}$, $\varepsilon_r = 6$ and the source oriented along x.

Make a plot of the amplitude variation of the x-component of spectral field at $z = h^+$ as a function of k_x from 0 to $3k_0$ with $k_y = 0$ at 10GHz and 20GHz.

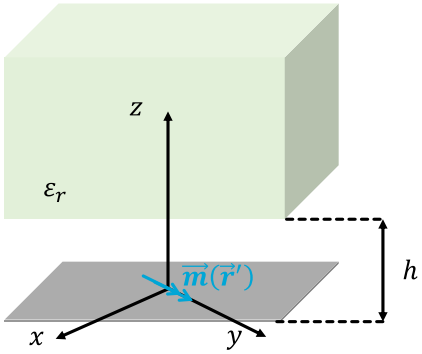
Question 2 (4 points):



Write a MATLAB routine to calculate the spectral Green's function for the electric field given by an elementary x-oriented magnetic source radiating at $z = 0$ with the presence of a ground plane and a dielectric layer of thickness h_s located at a distance of h from the ground plane, as shown in the figure.
Consider $h = 15.6\text{mm}$, $h_s = 2.6\text{mm}$, $\varepsilon_r = 10$.

Make a plot of the amplitude variation of the y-component of spectral field at $z = h + h_s^+$ as a function of k_y from 0 to k_0 with $k_x = 0$ for the following frequencies: 8GHz, 8.5GHz, 9GHz, 9.5GHz and 10GHz.

Question 3 (3 points):



Write a MATLAB routine to calculate the spectral Green's function for the electric field given by an elementary y-oriented magnetic source at $z = 0$ radiating into an infinite medium with a permittivity of ε_r in the presence of a ground plane and an air layer of thickness h, as shown in the figure.

Consider $h = 5\text{mm}$ and a frequency of 30GHz.

Make a plot of the amplitude variation of the x-component of spectral field at $z = h^+$ as a function of k_x from 0 to $2k_0$ with $k_y = 0$ for the following values of the permittivity $\varepsilon_r = 2.5,\ 6$ and 12.