MATLAB EXERCISE 2.8 **MATLAB computations of boundary conditions.** Assume that the plane $z = 0$ separates medium 1 ($z > 0$) and medium 2 ($z < 0$), with relative permittivities $\varepsilon_{r1} = 4$ and $\varepsilon_{r2} = 2$, respectively. The electric field intensity vector in medium 1 near the boundary (for $z = 0^+$) is $\mathbf{E}_1 = (4\,\hat{\mathbf{x}} - 2\,\hat{\mathbf{y}} + 5\,\hat{\mathbf{z}})$ V/m. In MATLAB, find the electric field intensity vector in medium 2 near the boundary (for $z = 0^-$), $\mathbf{E}_2$, if (a) no free charge exists on the boundary ($\rho_s = 0$) and (b) there is a surface charge of density $\rho_s = 53.12$ pC/m^2 on the boundary.

SOLUTION:

Using MATLAB programs from the previous two MATLAB exercises (for a horizontal boundary plane, $z = 0$) or general programs for an oblique plane (from MATLAB Exercises 2.4 and 2.5), we obtain: (a) $\mathbf{E}_2 = (4\,\hat{\mathbf{x}} - 2\,\hat{\mathbf{y}} + 10\,\hat{\mathbf{z}})$ V/m ($\rho_s = 0$) and (b) $\mathbf{E}_2 = (4\,\hat{\mathbf{x}} - 2\,\hat{\mathbf{y}} + 7\,\hat{\mathbf{z}})$ V/m ($\rho_s \neq 0$).