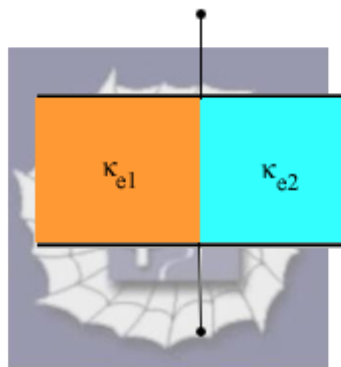


380.

Problem 31.54 (RHK)

A parallel-plate capacitor is filled with two dielectrics as shown in the figure. We have to show that its capacitance is given by

$$C = \frac{\epsilon_0 A}{d} \left(\frac{\kappa_{e1} + \kappa_{e2}}{2} \right).$$



Solution:

Let the area of the plates of the capacitor be A and separation of its plates be d . Let it be filled with materials having dielectric constants κ_{e1} and κ_{e2} as shown in the figure.

For calculating the capacitance of this capacitor we will consider that it is equivalent to two capacitances each of area $A/2$ and containing materials of dielectric constants κ_{e1} and κ_{e2} , respectively, which are connected in

parallel. Therefore, the capacitance of the combination will be

$$C = \frac{\epsilon_0 \kappa_{e1} A}{2d} + \frac{\epsilon_0 \kappa_{e2} A}{2d} = \frac{\epsilon_0 A}{d} \left(\frac{\kappa_{e1} + \kappa_{e2}}{2} \right).$$

