lab 3

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c and d

$$\begin{aligned}\delta A &= A\sqrt{\left(\frac{\delta l}{l}\right)^2 + \left(\frac{\delta h}{h}\right)^2} \\ &= 296.74\sqrt{\left(\frac{0.01}{19.60}\right)^2 + \left(\frac{0.01}{15.14}\right)^2} \\ &= 0.247662\end{aligned}$$

We know for this setup

$$C = \frac{K\epsilon_0 A}{D}$$

Therefore the graph of C vs $1/D$ should be linear with a slope of $K\epsilon_0 A$.

$$\begin{aligned}K\epsilon_0 A = m &= 6.328 \times 10^{-13} \\ K &= \frac{(6.328 \times 10^{-13})\ \mathrm{F} \times \mathrm{m}}{8.85 \times 10^{-12} \times \left(296.74\mathrm{cm}^2 \times \frac{1\mathrm{m}^2}{10000\mathrm{cm}^2}\right)} \\ &= 2.416\end{aligned}$$

$$\begin{aligned}\delta K &= K\sqrt{\left(\frac{\delta A}{A}\right)^2 + \left(\frac{\delta m}{m}\right)^2} \\ &= 2.416\sqrt{\left(\frac{0.248}{296.74}\right)^2 + \left(\frac{2.42 \times 10^{-14}}{6.35 \times 10^{-13}}\right)^2} \\ &= 0.092\end{aligned}$$

	100% Area	50.7% of Area
Capacitence (nF)	0.78	0.50

Table 1: Comparison of Whole Area and 50.7% of Area

$$\begin{aligned} C_{series} &= \frac{1}{\frac{1}{C_1} + \frac{1}{C_2}} \text{ nF} \\ &= \frac{1}{\frac{1}{3.52\text{nF}} + \frac{1}{3.52\text{nF}}} \\ &= 1.76 \text{ nF} \end{aligned}$$

$$\begin{aligned} C_{parallel} &= C_1 + C_2 + C_3 \text{ nF} \\ &= 3.52\text{nF} + 3.52\text{nF} + 3.52\text{nF} \\ &= 10.56 \text{ nF} \end{aligned}$$