Assigment 2

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Question 1

Part a

As stated in the question, we are required to calculate C_{wire}, which can be expressed by the following equation:

$$C_{wire} = C_{pp} + C_{fringe} \tag{1}$$

Calculating parallel plate capacitance

Based on the lecture notes, this can be calculated in the following way:

$$C_{pp} = \frac{38 * 10^{-18}}{1 * 10^{-12}} * 250 * 10^{-6} * 0.4 * 10^{-6} = 3800 * 10^{-18} F = 3800aF \tag{2}$$

Calculating fringing capacitance

This can be found in the following way:

$$C_{fringe} = \frac{13 * 10^{-18}}{10^{-6}} * 250 * 10^{-6} = 3250 * 10^{-18} = 3250aF \tag{3}$$

Since fringe capacitance needs to include for both the side walls, the value needs to be doubled, that is:

$$C_{fringe} = 3250 * 2 = 6500aF \tag{4}$$

Calculating the capacitance of the wire

Based on (2) and (4), we can determine the capacitance of the wire in the following way:

$$C_{wire} = C_{pp} + C_{fringe} = 3800 + 6500 = 10300aF = 10.3fF \tag{5}$$

Part b

The goal is to calculate the R_{wire}, given that the sheet metal resistance (R_0) is $0.08\frac{\Omega}{sq}$. The width is given to to be 0.4μm, hence the goal is to fit as many squares of this size into the available length. This can be done in the following way:

$$R_{wire} = 0.08 * \frac{250 * 10^{-6}}{0.4 * 10^{-6}} = 50\Omega \tag{6}$$

Question 2