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| **August 4, 2018** | **EE735: Microelectronics Simulations Lab** | ***Vineesh A.S.V*** |
| **Saturday** | **Assignment:#1** | ***Roll No:173079020*** |

# Q1.

## Procedure

- Enclose the given parallel plate capacitor in a potential box, in this problem the dimensions of the potential box are taken as 3000x500
- One of the plates is kept at 1 V while other one is kept at 0V. Walls of the potential box is kept at 0V;
- Divide the entire box into mesh with grid size = 1nm
- Solve poissons equation in the charge free regions and find potential across all grid points
- To find the electric field take the gradient of the potential across the all grid points
- To find the charge per unit width on the plate, find the total flux emerging out of the plates
- capacitance is given a charge per unit width divided by the capacitance across the plate

**Net capacitance per unit Width = 1.072 nF**. The simulated capacitance is close to the ideal value $C = (l * \epsilon)/d = 0.885nF$.

# Q2.

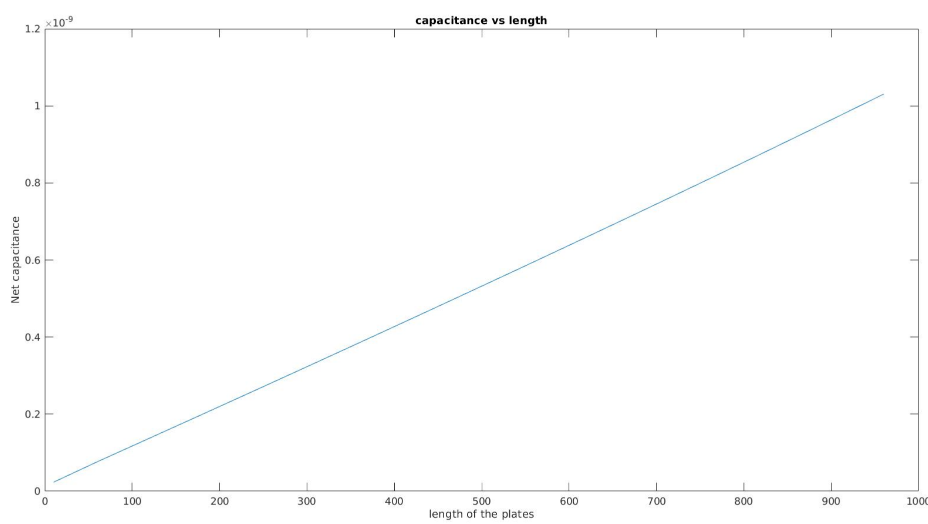


Figure 1: Net capacitance vs length

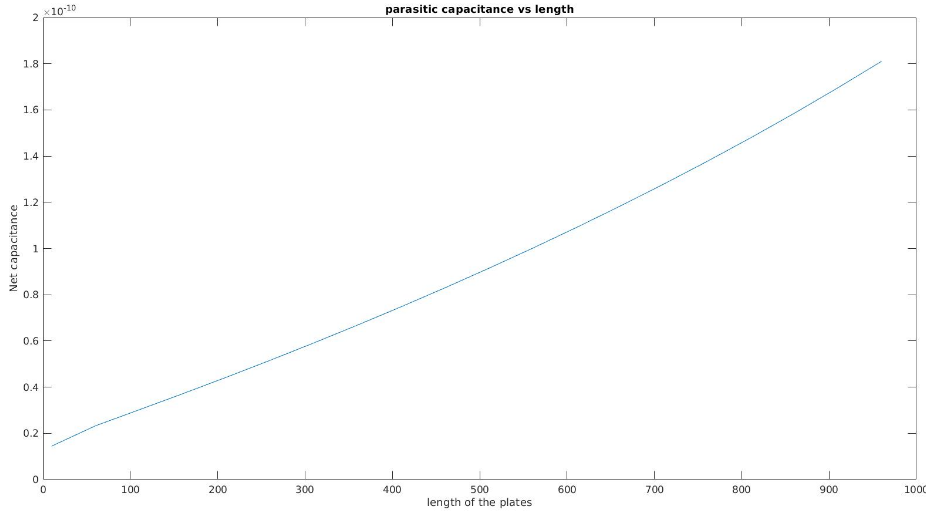


Figure 2: Parasitic capacitance vs length

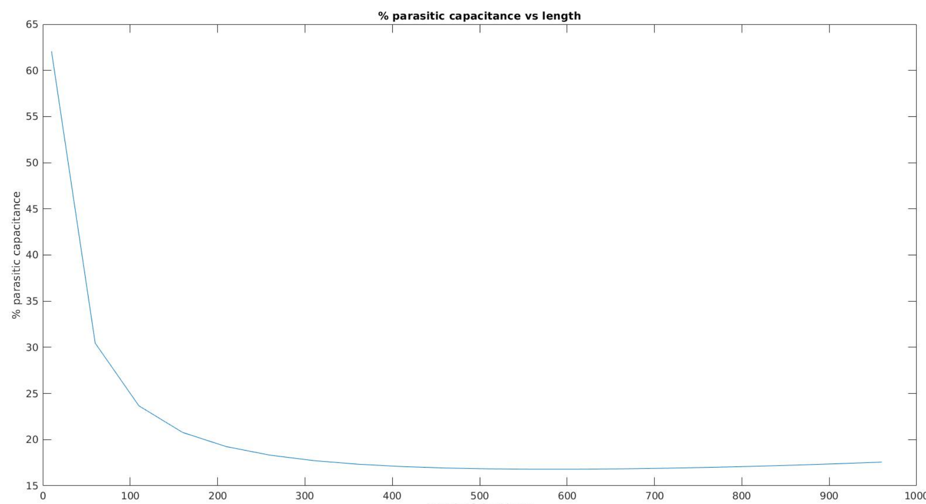


Figure 3: Percentage Parasitic capacitance vs length

As shown in Fig 3 Percentage parasitic capacitance per width decreases with increasing length. As the length of the plates decreases, the fringing of the electric field becomes more dominant adding to the net capacitance.

# Q3.

**Net capacitance = 29 pf**

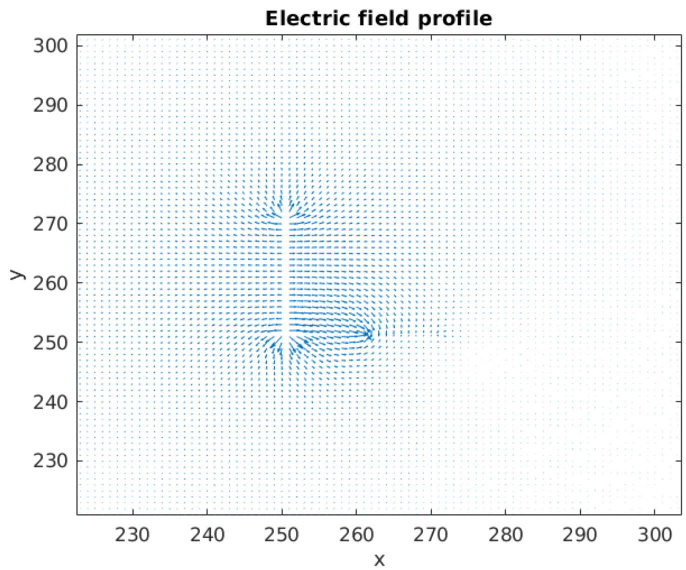


Figure 4: Electric Field Profile E(x,y)

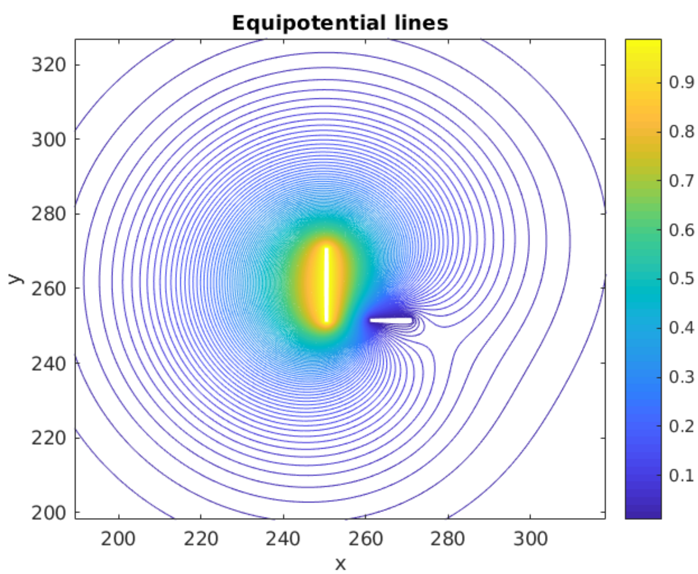


Figure 5: Equipotential lines

**Maximum Electric Field : 0.23 V/m. The magnitude of the electric field is maximum at the lower end of the vertical plate which is closer to the horizontal plate. The maximum electric field is directed at angle of** $47\,\mathrm{deg}$ **anti-clockwise from the horizontal axis**

| File name | Description |
|---|---|
| cap_solver.m | function to find the net capacitance<br>of a parallel plate capacitor for a given l,d |
| q1.m | Code for question 1 |
| q2.m | Code for question 2 |
| q3.m | Code for question 3 |
| 173079020_vineesh_hw1.pdf | this document |

Table 1: Contents of zip file