Computational Microelectronics, 2018 Fall

Homework #4

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# Double-gate MOS

## Introduction

We think of the double gate MOS that 50 nm thick silicon is covered with 5 nm thick silicon dioxide at both ends. We know that relative permittivity of silicon and silicon dioxide is 11.7 and 3.9 respectively. And we assumed that

ni = 1.075e10 /cm^3

Nacc = 1e18 /cm^3

Each displacement = 0.1e-9 m

Temperature = 300 K

Furthermore, we applied 0 voltage to the device and assumed that 0.33374 gate voltage occur because of the contact metal.

## Result

1. Electrostatic potential

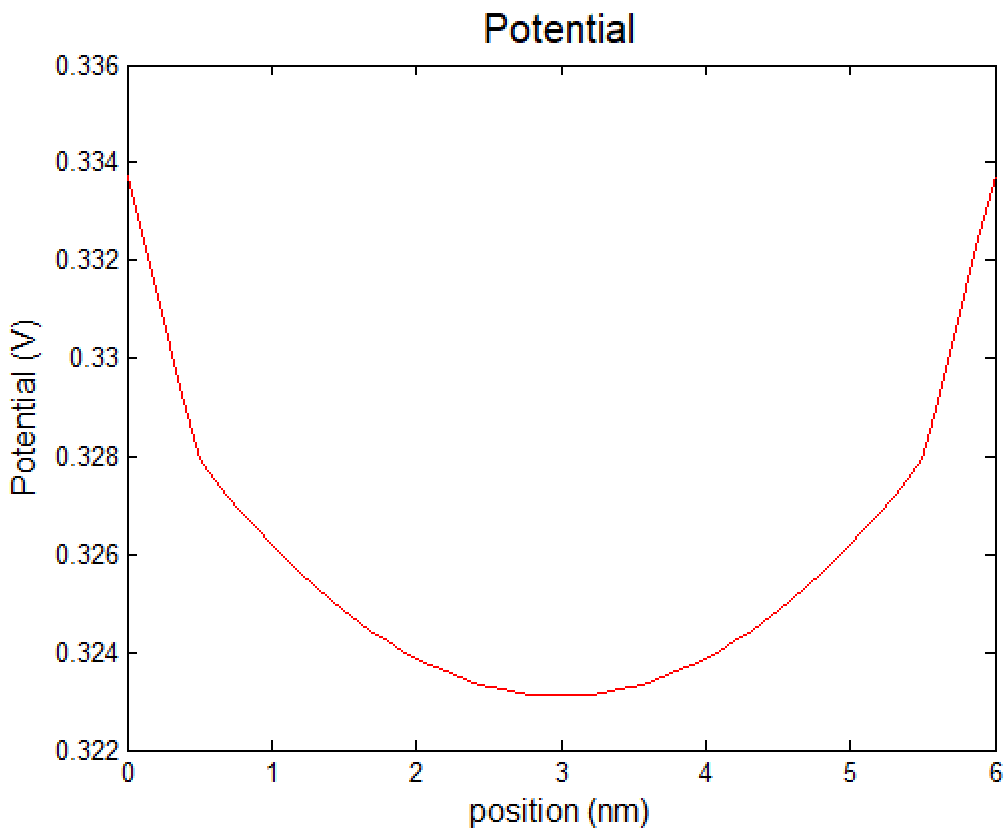

Figure 1.  Electrostatic potential

2. Electron density calculated by $\mathrm{n(r)} = n_i \exp\left(\frac{q\phi}{k_B T}\right)$

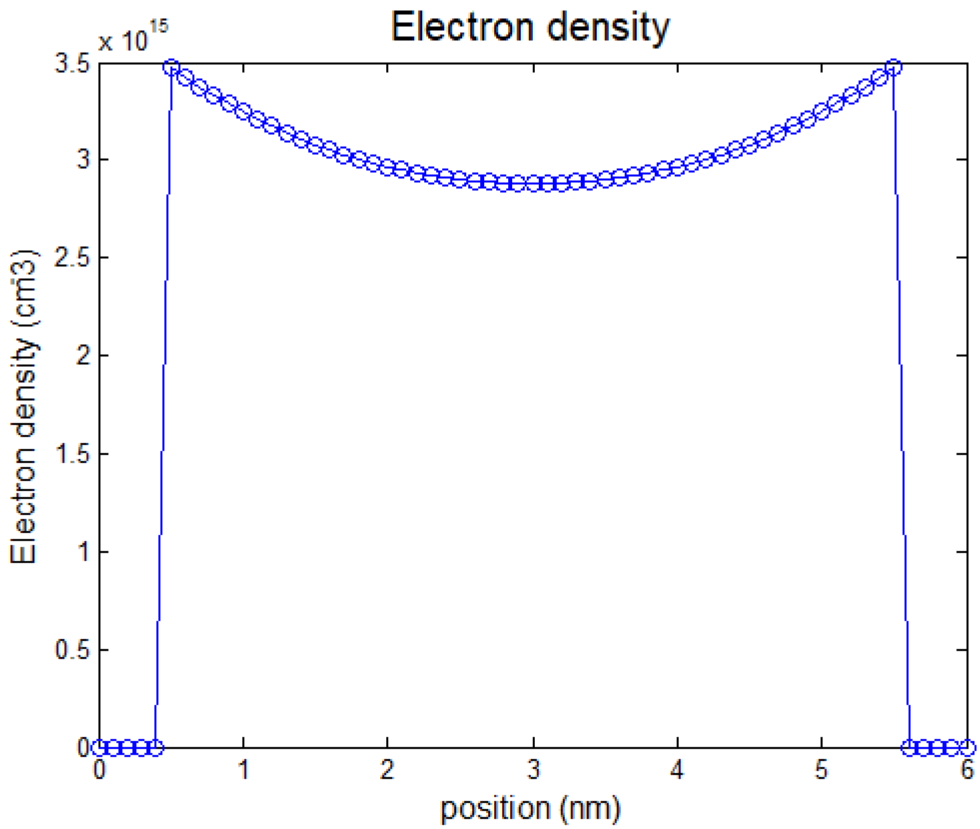


Figure 2. Electron density

3. Re-calculate the potential with electron density

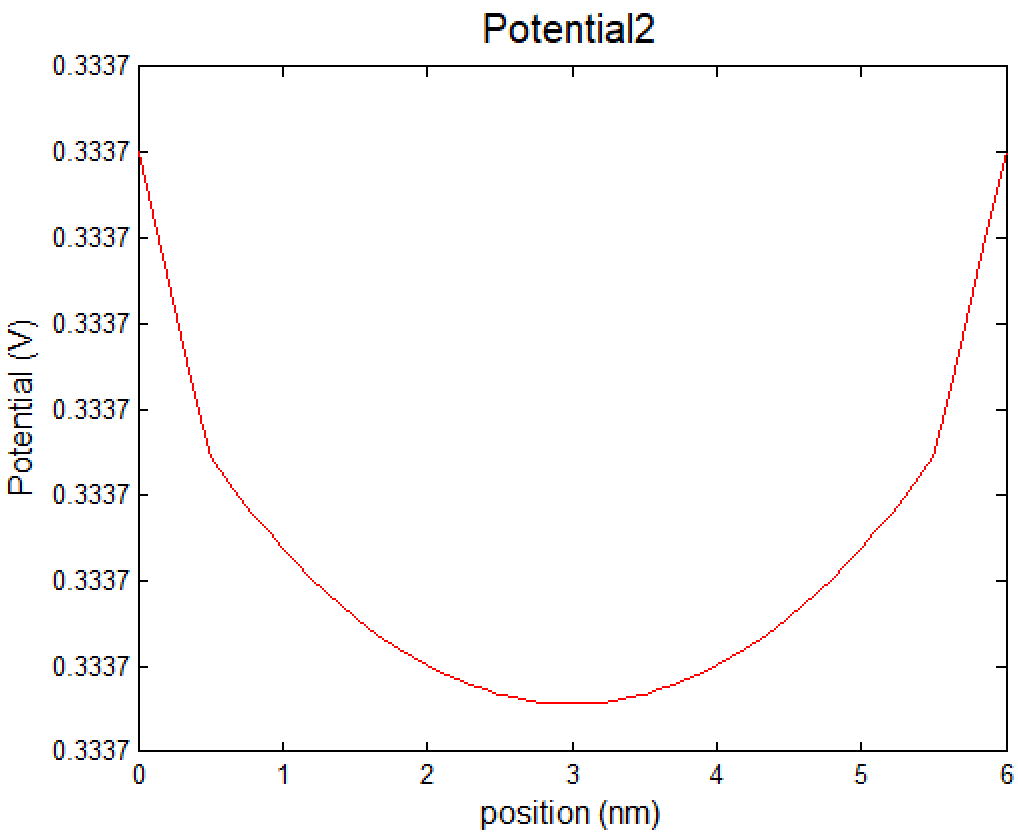


Figure 3. Re-calculate the potential with electron density

4. Potential difference

Potential difference is calculated by

$$\text{Potential difference} = \text{recalculated potential} - \text{Initial potential}$$

Which gives

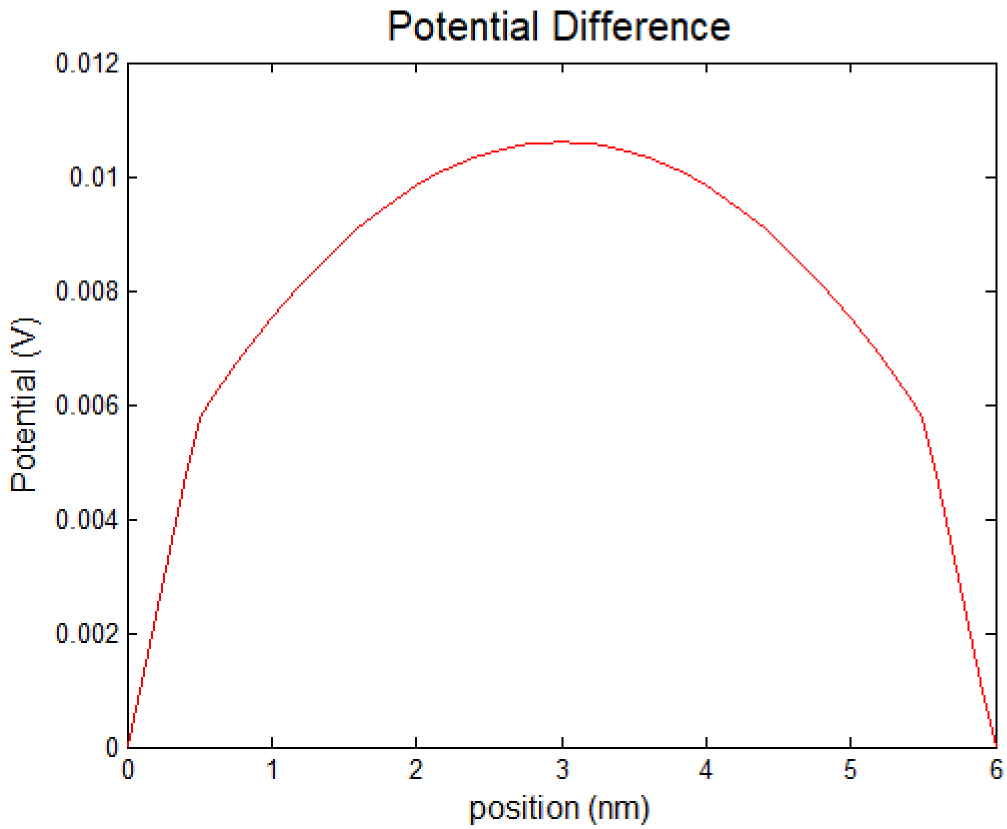

Figure 4. Potential difference

Potential difference occurs because when we calculate initial electric potential, we use Nacc and ignore distribution of charge.

5. Potential difference with respect to gate voltages

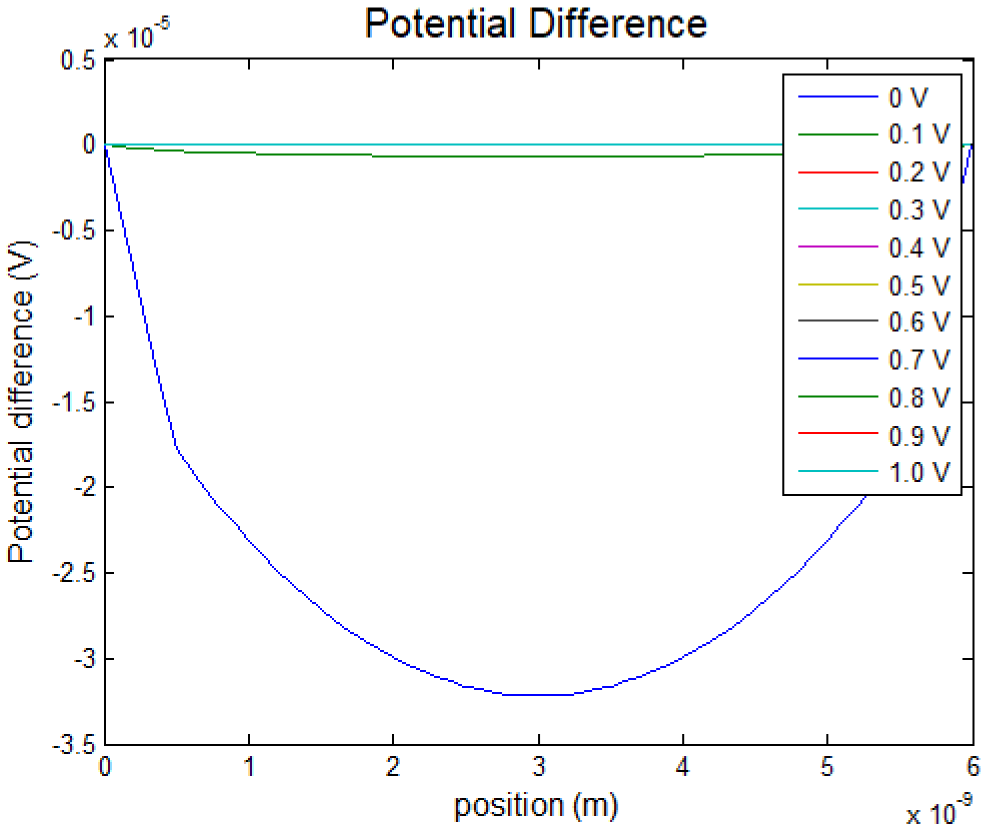

Figure 5. Potential difference with respect to gate voltages

Potential difference tends to decrease as we apply the gate voltage