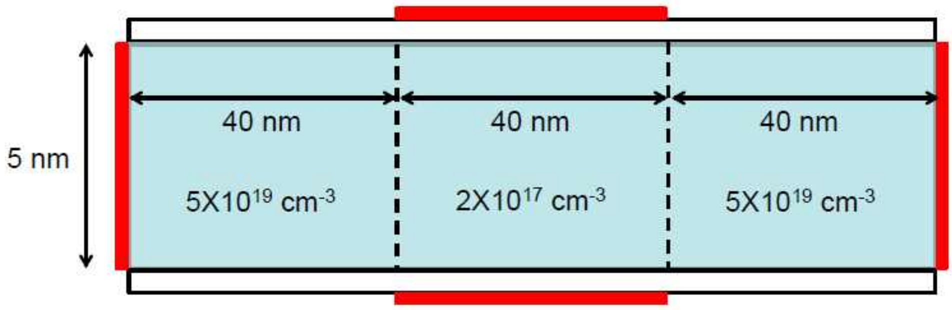
계산전자공학 Term project 20182018 주원빈

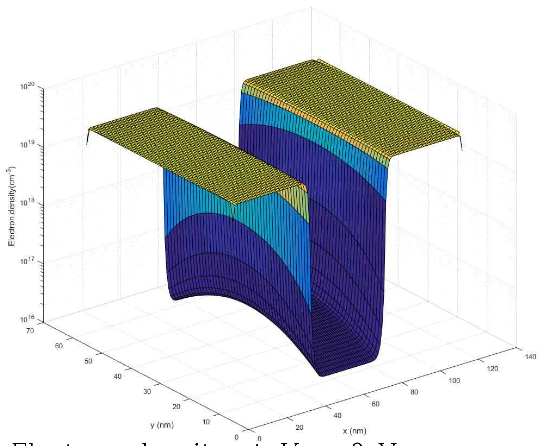
Double gate structure

- Double-gate 5-nm-thick silicon & 0.5-nm-thick oxide at both sides
- 40-nm-long gate (Workfunction: 4.3 eV)

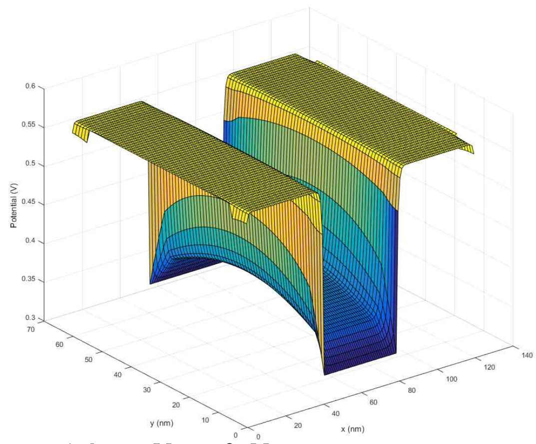


Step 1

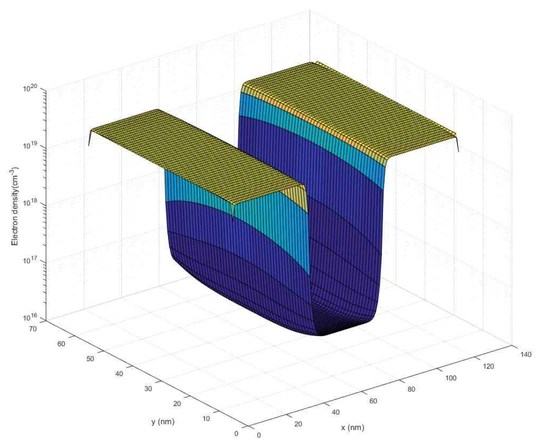
- Solve the nonlinear Poisson equation for the double-gate structure.
- V_S=V_D=0 and V_G varies from 0 V to 1 V. (0.1 V step)



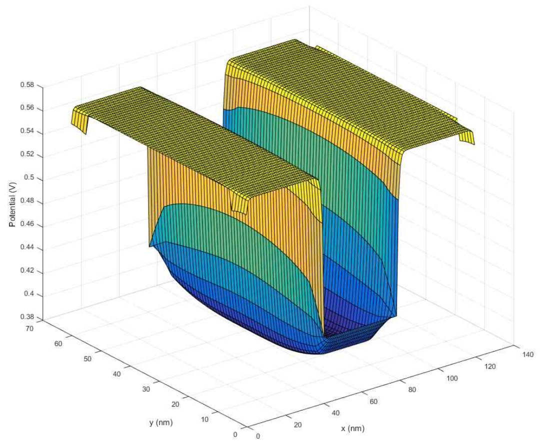
Electron density at V_D = 0 V



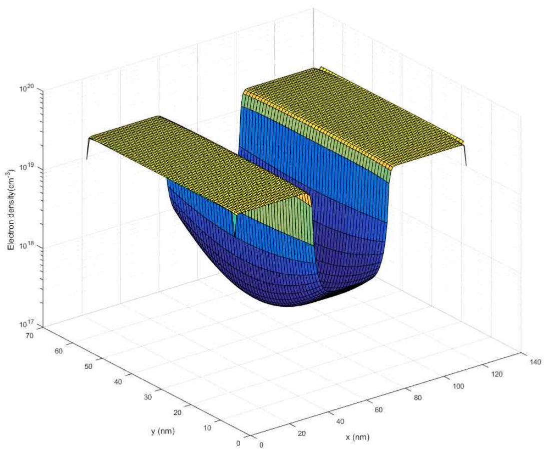
Potential at V_D = 0 V



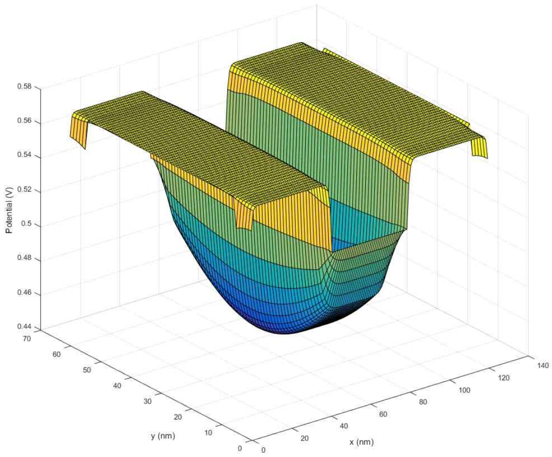
Electron density at V_D = 0.1 V



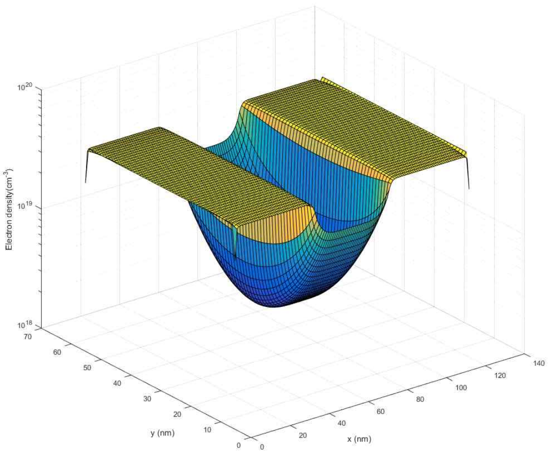
Potential at V_D = 0.1 V



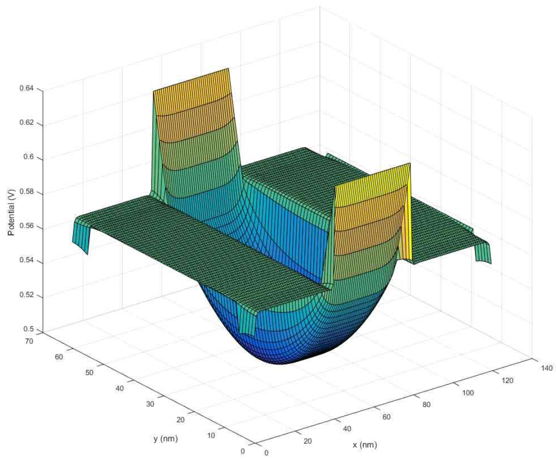
Electron density at V_D = 0.2 V



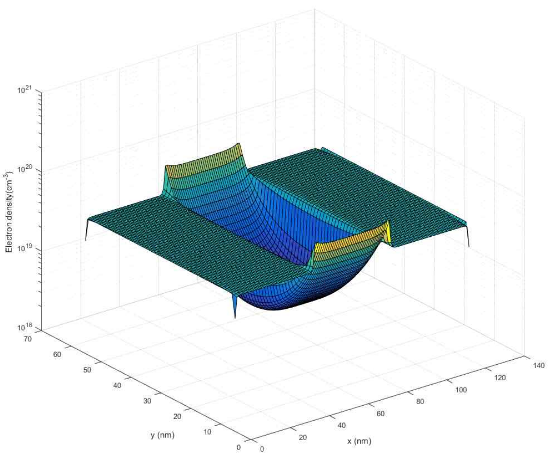
Potential at V_D = 0.2 V



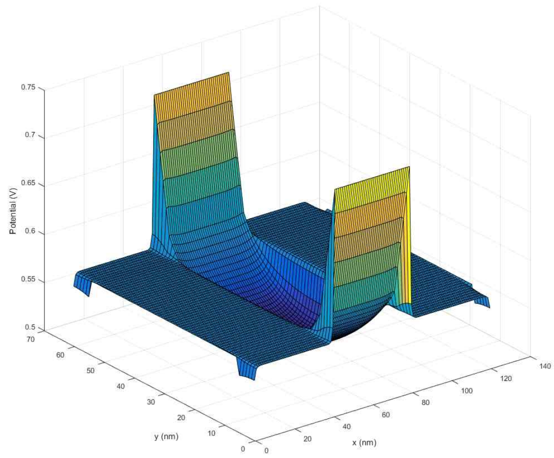
Electron density at V_D = 0.3 V



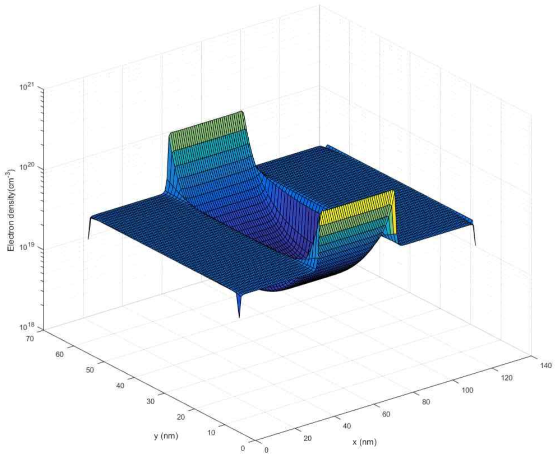
Potential at V_D = 0.3 V



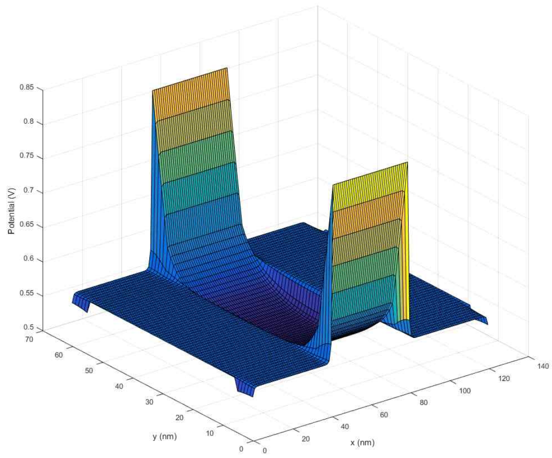
Electron density at V_D = 0.4 V



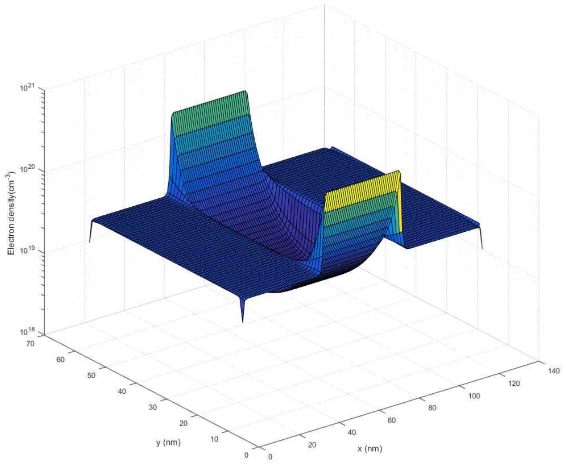
Potential at V_D = 0.4 V



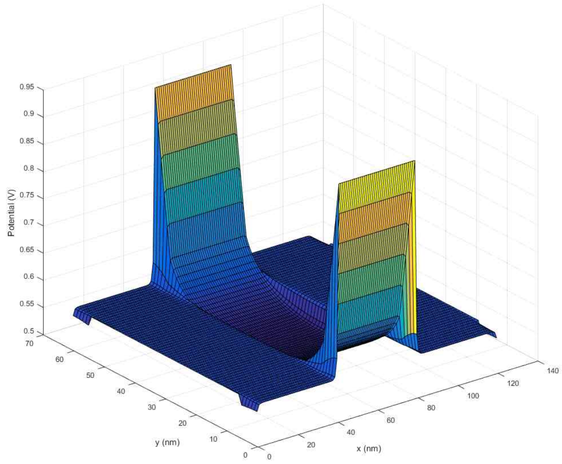
Electron density at V_D = 0.5 V



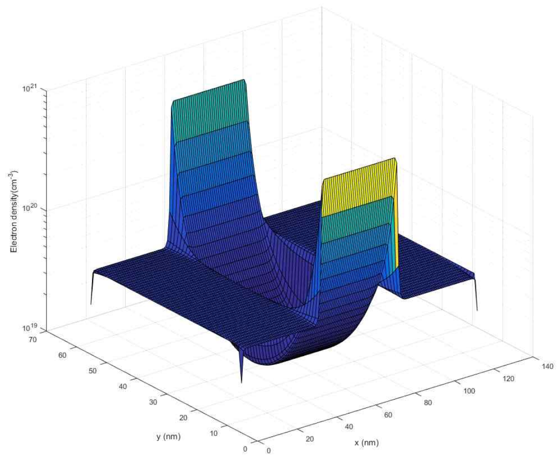
Potential at V_D = 0.5 V



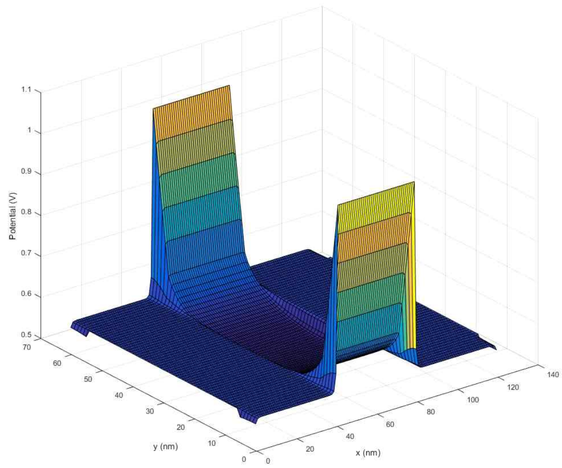
Electron density at V_D = 0.6 V



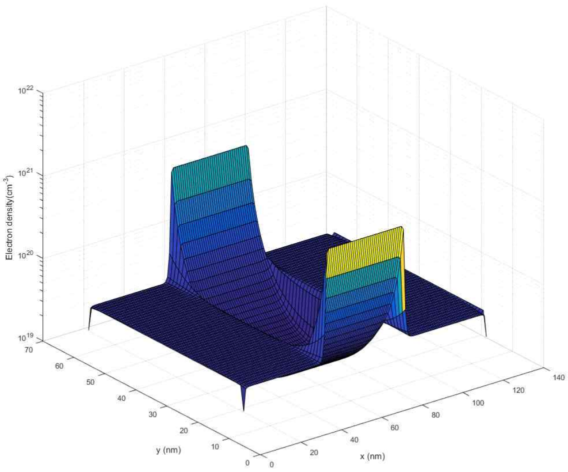
Potential at V_D = 0.6 V



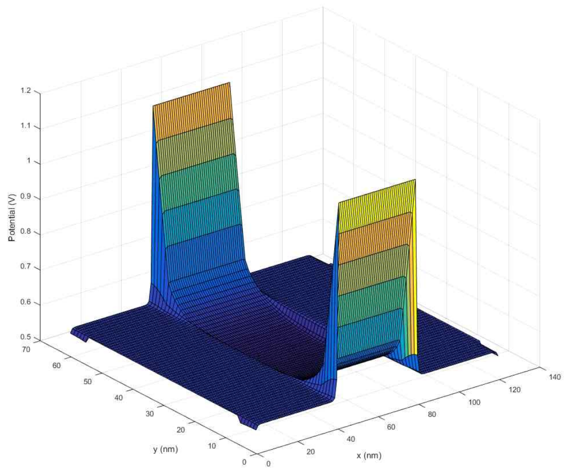
Electron density at V_D = 0.7 V



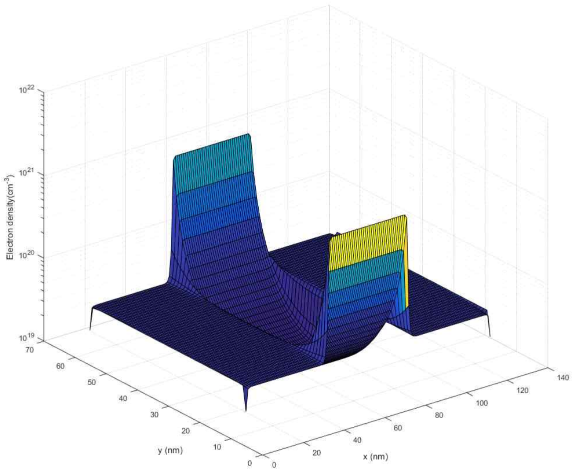
Potential at V_D = 0.7 V



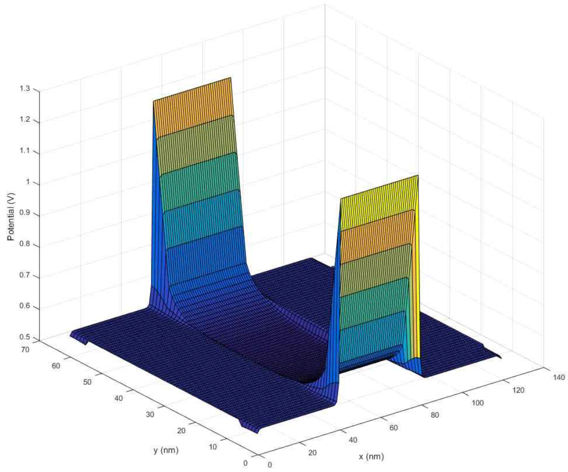
Electron density at V_D = 0.8 V



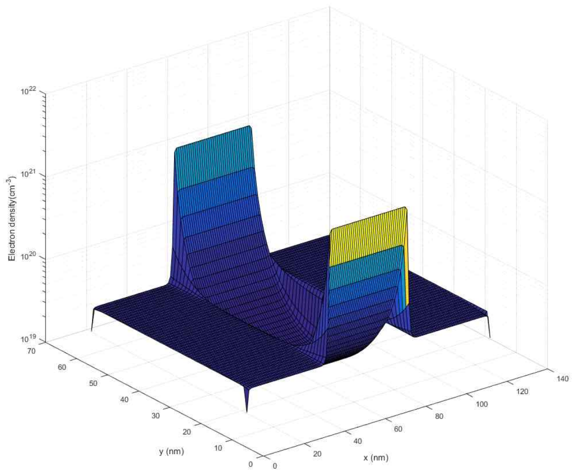
Potential at V_D = 0.8 V



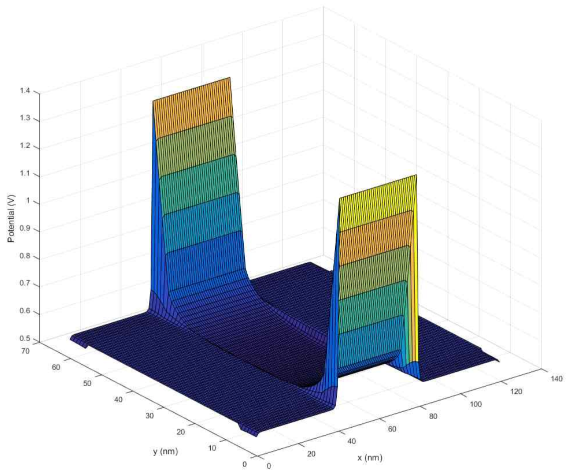
Electron density at V_D = 0.9 V



Potential at V_D = 0.9 V



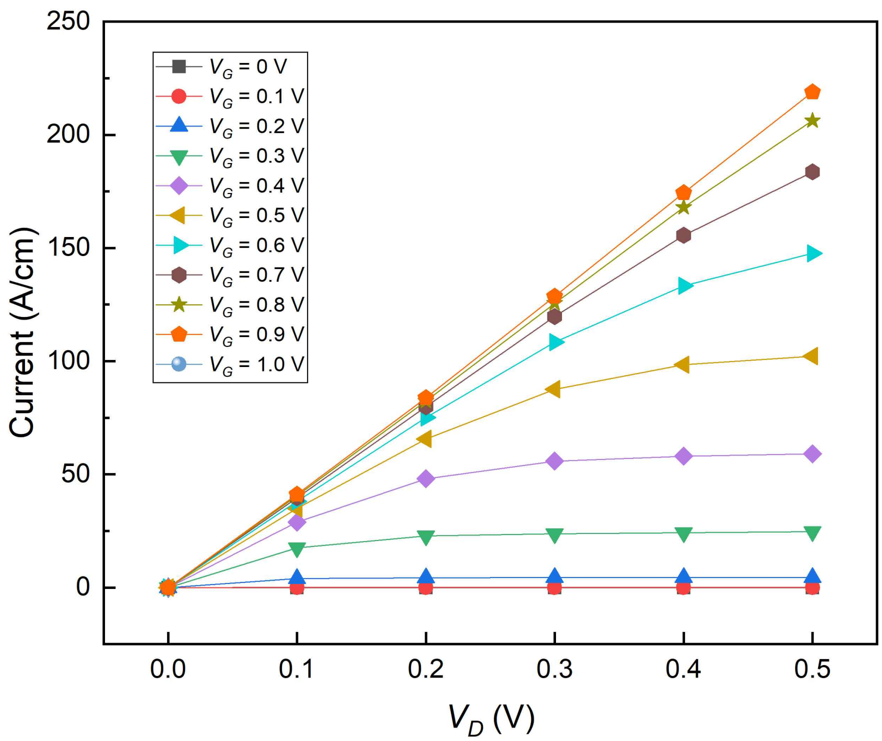
Electron density at V_D = 1.0 V



Potential at V_D = 1.0 V

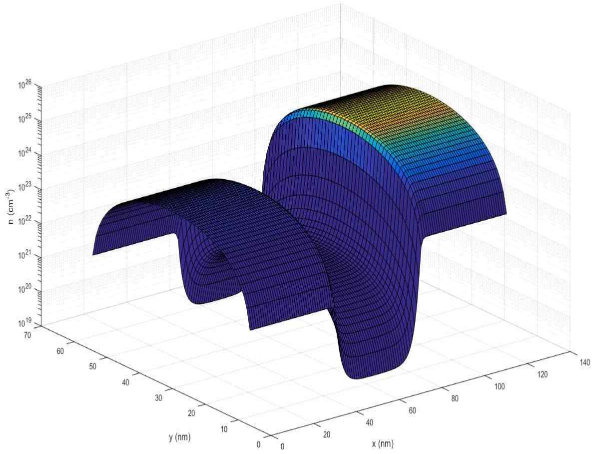
Step 2

- Solve the drift-diffusion equation for the double-gate structure.
- Self-consistent simulation is mandatory.
- VS=0
- VG varies from 0 V to 1 V. (0.1 V step)
- VD varies from 0 V to 0.5 V. (0.1 V step)
- The electron mobility is assumed to be 1430 cm2/V sec.

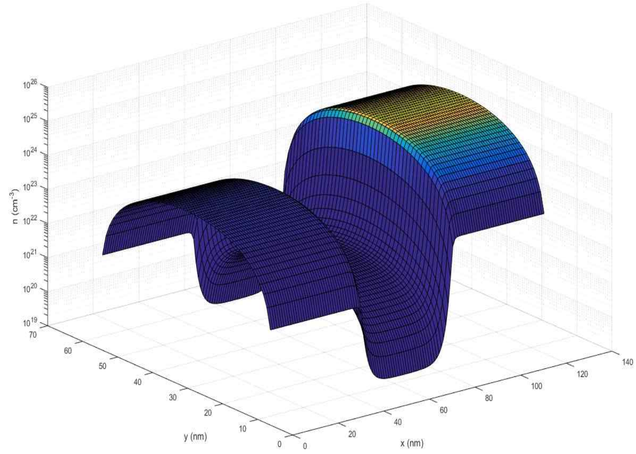


Step 3

- Solve the Schrödinger equation.
- Use ϕ obtained in Step2.
- V_S=0
- Consider VG of 0.1 V and 0.5 V.
- Consider VD of 0.1 V and 0.5 V.
- Consider three different valleys.



Electron density at V_S = 0.1 V and V_G = 0.1 V
mxx = 0.91; myy = 0.19; mzz = 0.19



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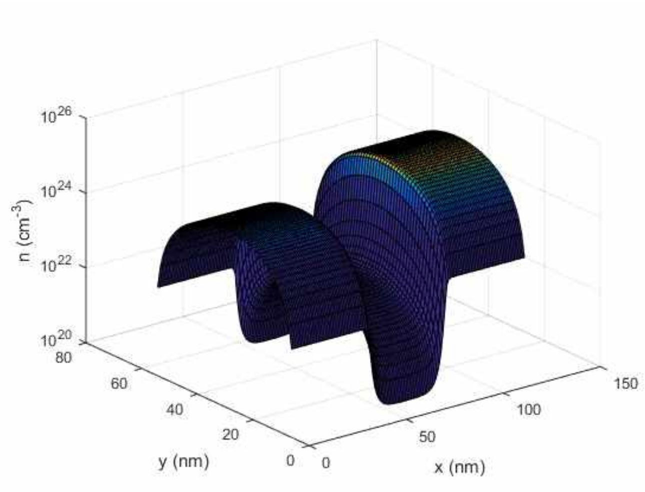
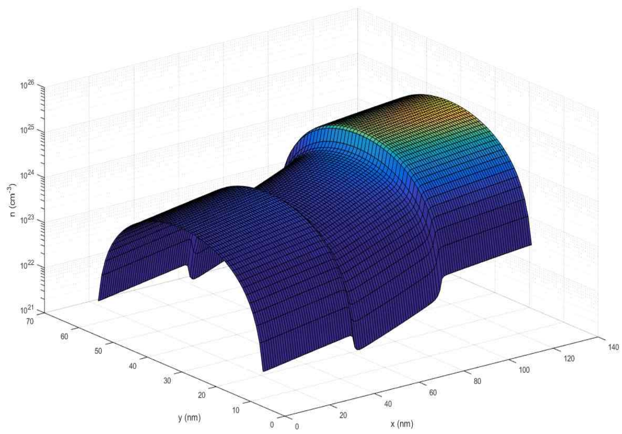
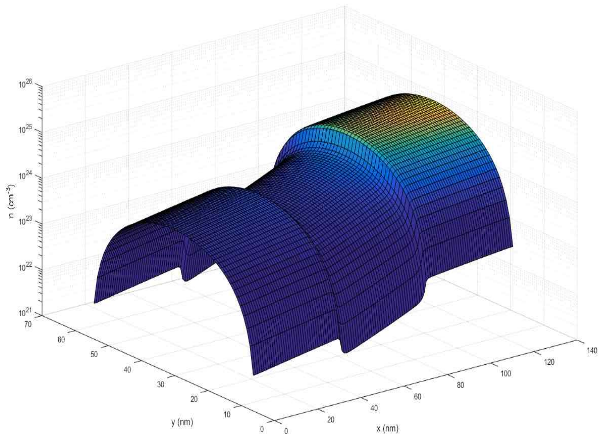
mxx = 0.19; myy = 0.91; mzz = 0.19



Electron density at V_S = 0.1 V and V_G = 0.1 V
mxx = 0.19; myy = 0.19; mzz = 0.91



Electron density at V_S = 0.1 V and V_G = 0.5 V
mxx = 0.91; myy = 0.19; mzz = 0.19



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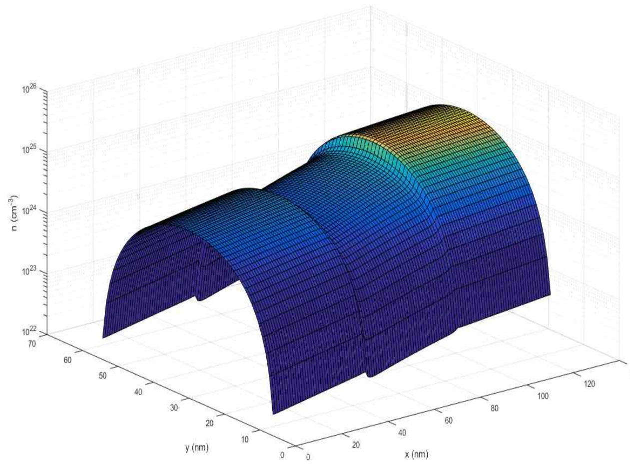
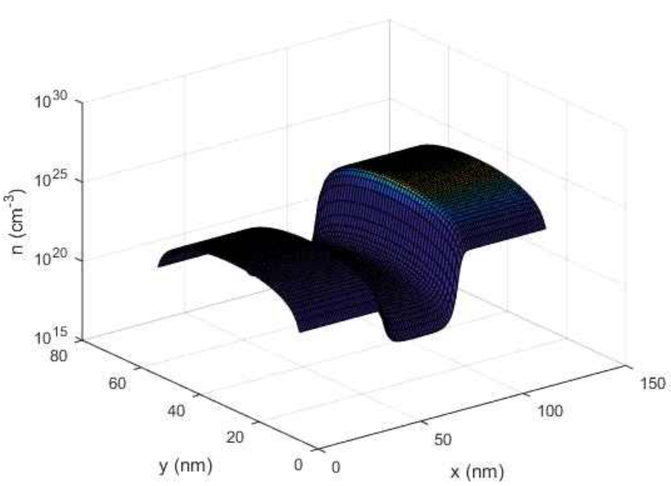
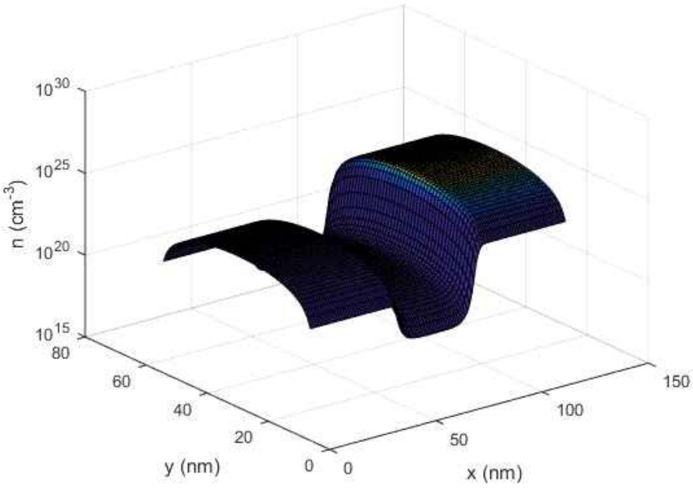
mxx = 0.19; myy = 0.91; mzz = 0.19



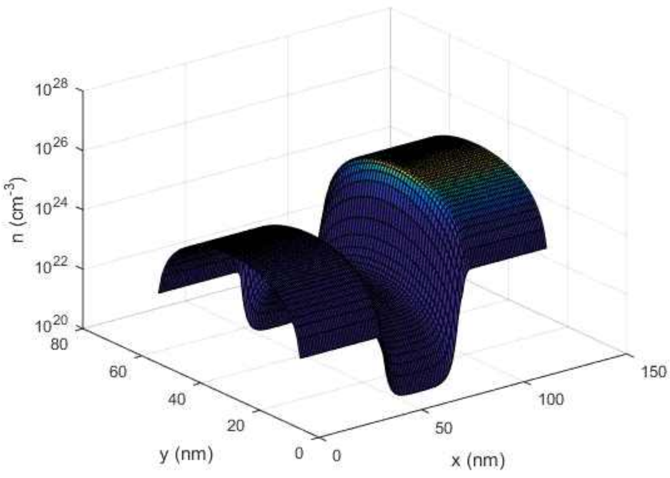
Electron density at V_S = 0.1 V and V_G = 0.5 V
mxx = 0.19; myy = 0.19; mzz = 0.91



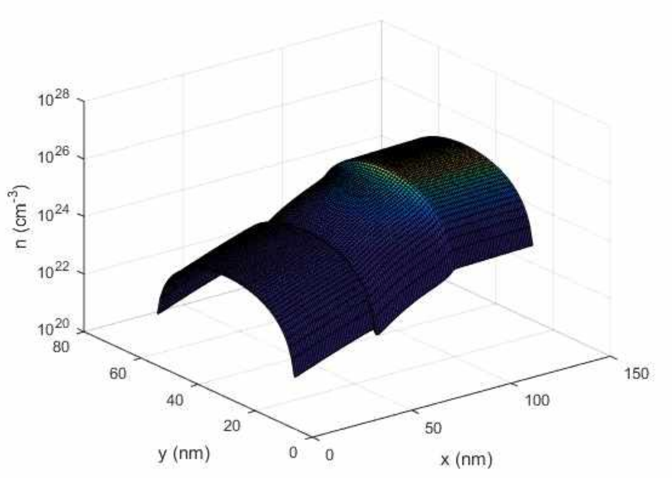
Electron density at V_S = 0.5 V and V_G = 0.1 V
mxx = 0.91; myy = 0.19; mzz = 0.19



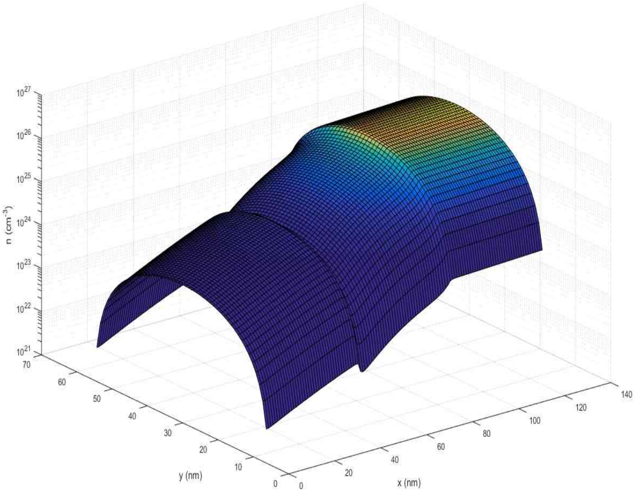
Electron density at V_S = 0.5 V and V_G = 0.1 V
mxx = 0.19; myy = 0.91; mzz = 0.19



Electron density at V_S = 0.1 V and V_G = 0.5 V
mxx = 0.19; myy = 0.19; mzz = 0.91



Electron density at V_S = 0.5 V and V_G = 0.5 V
mxx = 0.91; myy = 0.19; mzz = 0.19



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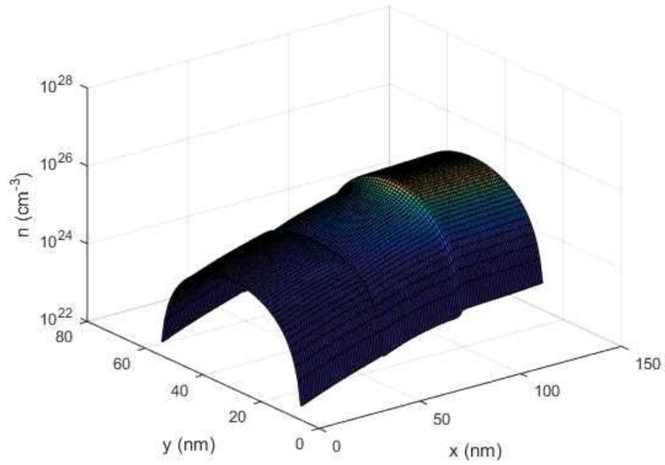
mxx = 0.19; myy = 0.91; mzz = 0.19



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mxx = 0.19; myy = 0.19; mzz = 0.91