Computational Microelectronics [HW-13]

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Data: 18/12/10

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1. Simulation explanation

In the previous lecture, we have treated the drift-diffusion equation at the non-equilibrium condition. So we are going to calculate the current as a function of the voltage. We learned how to calculate the terminal current under the assumption of the Scharfetter-Gummel scheme and used the assumption to get the simulated results. Another problem is about the RC filter which consider the simple circuit problem and we would compare the numerical solution with the analytic solution using Kirchhoff's law and the backward Euler method.

2. Results and discussion

In the Figure.1, we calculated the numerical results from the coupled equation between the nonlinear Poisson's equation and the continuity equation in the long and short cases as a function of the bias voltage in the range from 0 to 1 V. the electron density has the urgent slope at the interface between oxide and Silicon as the voltage increases. The terminal current at the x = 600 nm in the NNN structure is linearly increased at the low voltage, but the linearity diverges as the voltage approaches to 1 V.

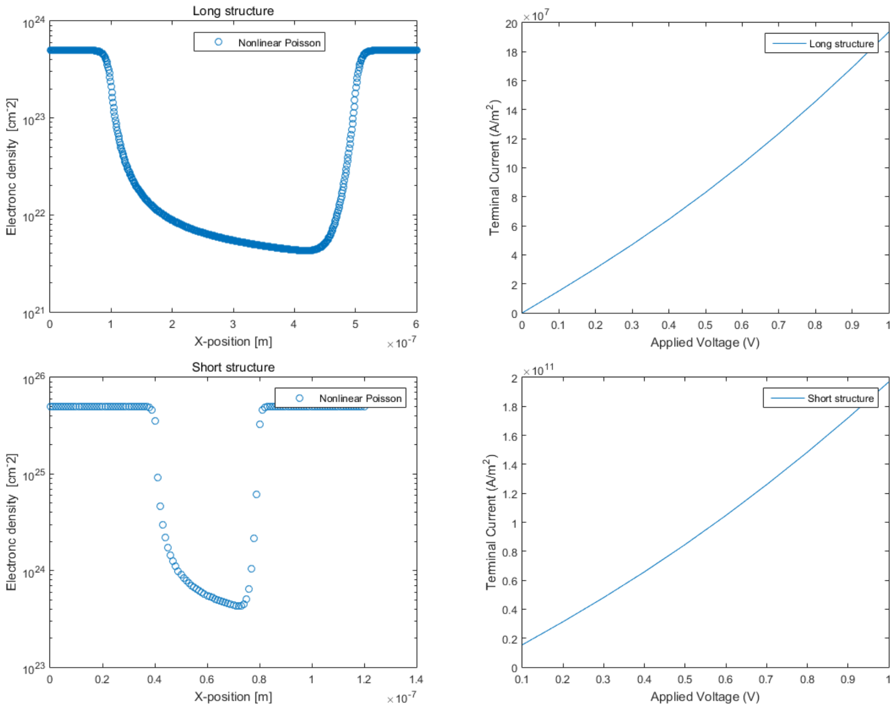

Figure 1. The IV curve of the long and the short NNN structures

In Figure.2, we got the transient simulation results at various frequencies in the RC filter. As you can see, the difference between the numerical result and the analytic result become larger as the frequency is more increased.

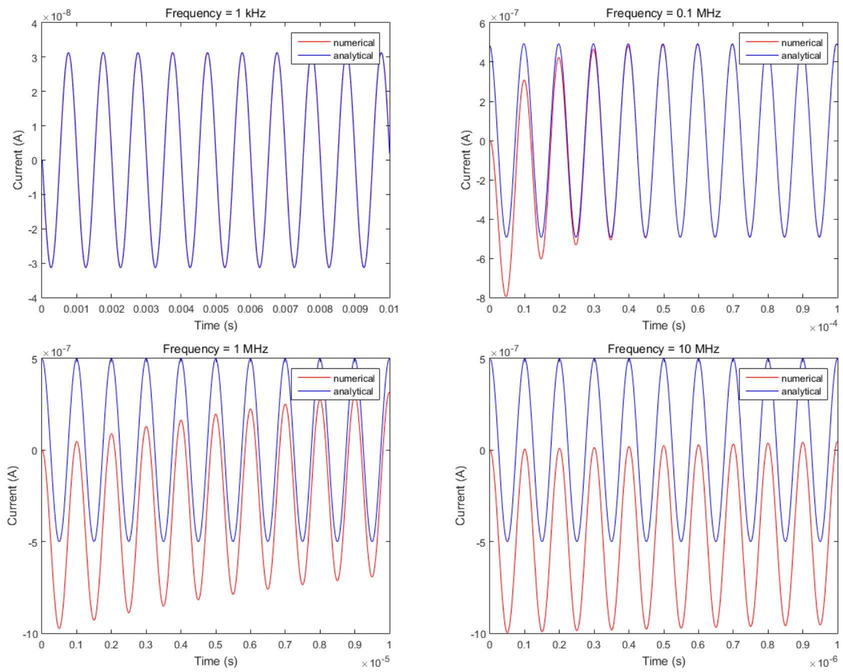

Figure 2. The transient simulation results and the analytic solution at various frequencies