Homework #13
Computational Microelectronics

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Due on December 10, 2018

1 Results

First, we obtain the current at the bias voltage from 0 V to 1.0 V, by solving the coupled equations: the continuity equation and the Poisson equation. We consider two structure, long structure with 600 nm and short structure with 120. We apply the spatial spacing value to 1 nm, and bias voltage step to 0.01 V.

Fig. 1 and 2 shows the current density at the drain for the long and short structure, respectively. We find that the current increases almost linearly as the bias voltage increases. At $V > 0.5$, the current increases faster than the linear behavior.

Second, we consider the RC filter discussed in the lecture 22. We obtain the current at specific input frequencies by solving the system of linear equations. Fig. 1 and 2 shows the current at 100 Hz and 500000 Hz, respectively. We find that at low frequency, the exact solution agrees with the numerically obtained solution. However, at high frequency (500000 Hz or higher), the numerical solution converges to the exact solution after some time. This is because the exact solution represents only the stationary case, while the simulation shows the process to the stationary state.

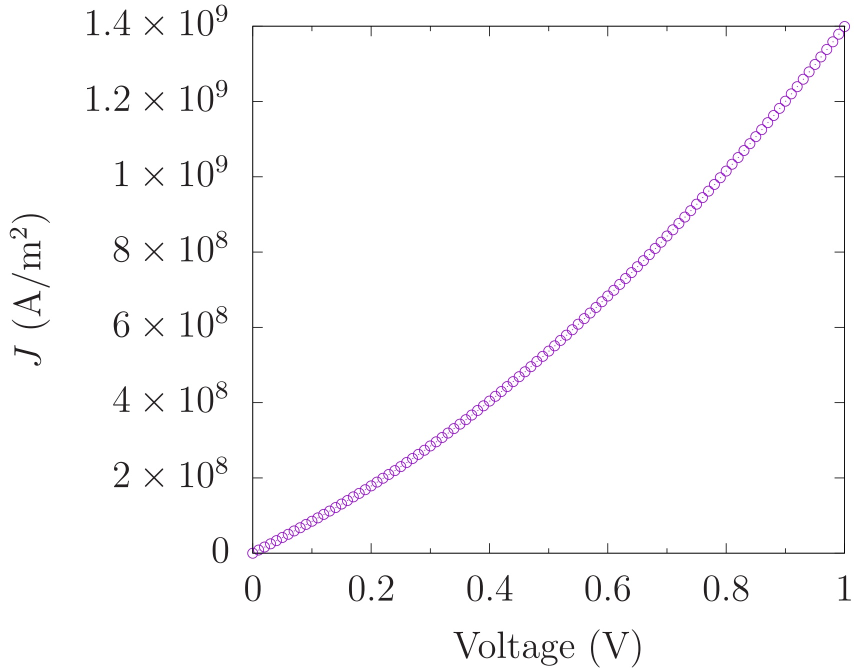

Figure 1: The current density at the drain for the long structure.

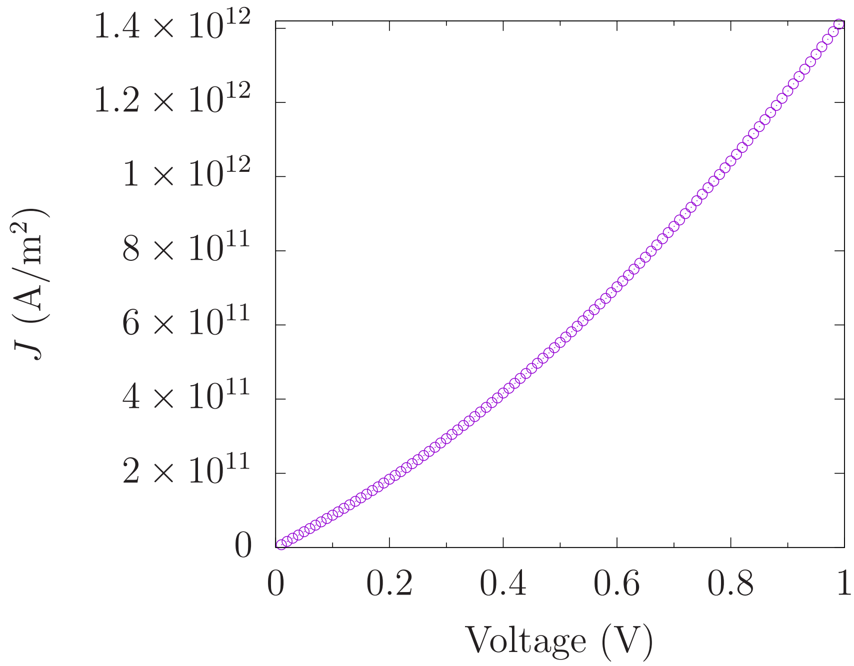

Figure 2: The current density at the drain for the short structure.

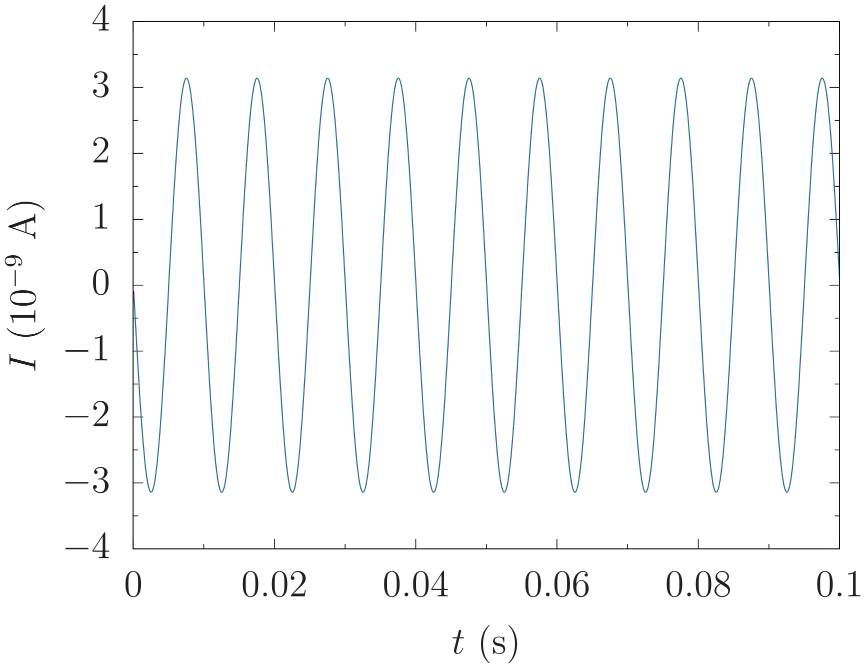

Figure 3: The current as a function of time t at 100 Hz input frequency. The purple line represents the numerical solution, while the green line displays the exact solution.

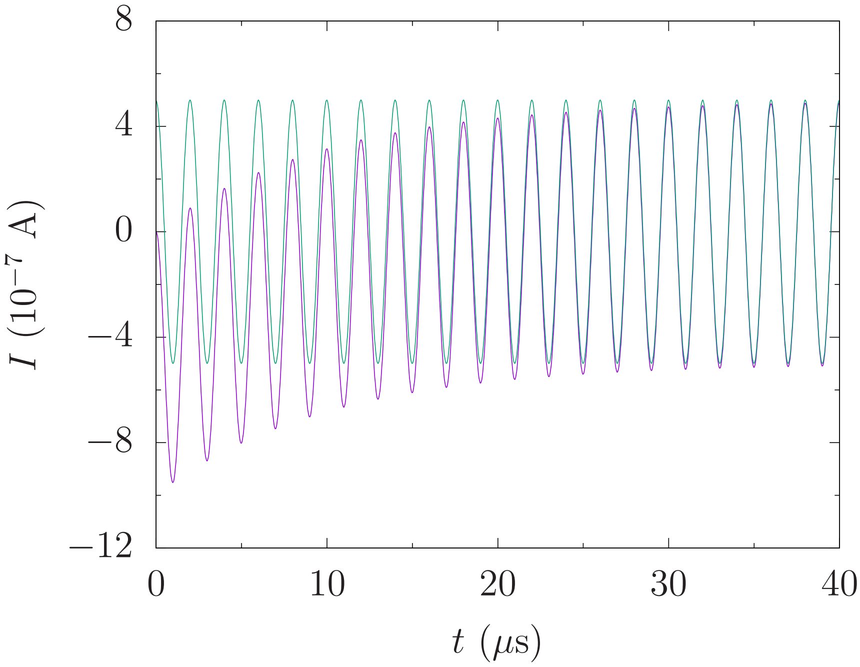

Figure 4: The current as a function of time t at 500000 Hz input frequency. The purple line represents the numerical solution, while the green line displays the exact solution.