Lecture24:
Green's function

Sung-Min Hong (smhong@gist.ac.kr)

Semiconductor Device Simulation Lab.
School of Electrical Engineering and Computer Science
Gwangju Institute of Science and Technology

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Calendar

- Plan for remaining lectures
  - Two more lectures

Mon	Tue	Wed	Thu	Fri	Sat	Sun
		~~16 (L18)~~	17	18	19	20
~~21 (L19)~~	22	~~23 (L20)~~	24	~~25 (L21)~~	26	27
28 (No lecture)	29	~~30 (L22)~~	Dec.1	~~2 (L23)~~	3	4
5 (No lecture)	6	7 (No lecture)	8	9	10	11
12 (L24)	13	14 (L25)	15	16 (Final)	17	18

Linearization revisited

- Semiconductor equations
  - Linearized form:

$$\nabla \cdot \delta \mathbf{J}_\phi = j\omega q(\delta p - \delta n)$$
$$\nabla \cdot \delta \mathbf{J}_n = j\omega q \delta n$$
$$\nabla \cdot \delta \mathbf{J}_p = -j\omega q \delta p$$

  - $\delta\mathbf{J}$'s are fluctuations of the current density.

Perturbation

- Consider some perturbations to the semiconductor equations.
  - These perturbations are denoted as δs's.

$$\nabla \cdot \delta\mathbf{J}_\phi = j\omega q(\delta p - \delta n) + s_\phi$$
$$\nabla \cdot \delta\mathbf{J}_n = j\omega q\delta n + s_n$$
$$\nabla \cdot \delta\mathbf{J}_p = -j\omega q\delta p + s_p$$

  - For example, s_ϕ can be a (time-varying) dopant fluctuation.
  - Another example is a velocity flucation, which becomes s_n or s_p.
  - Since it is a linear system, we can solve it with a Dirac delta function. For example,

$$\nabla \cdot \delta\mathbf{J}_\phi = j\omega q(\delta p - \delta n) + \delta(\mathbf{r} - \mathbf{r}_0)$$
$$\nabla \cdot \delta\mathbf{J}_n = j\omega q\delta n$$
$$\nabla \cdot \delta\mathbf{J}_p = -j\omega q\delta p$$

How to discretize it

- Recall the box method.
  - When the box contains $\mathbf{r}_0$, it simply becomes

$$\int_{Box\,surface} \delta\mathbf{J}_\phi \cdot d\mathbf{a} = j\omega q \int_{Box} (\delta p - \delta n) d\mathbf{r} + 1$$

$$\int_{Box\,surface} \delta\mathbf{J}_n \cdot d\mathbf{a} = j\omega q \int_{Box} \delta n d\mathbf{r}$$

$$\int_{Box\,surface} \delta\mathbf{J}_p \cdot d\mathbf{a} = -j\omega q \int_{Box} \delta p d\mathbf{r}$$

  - When the box doesn’t, the unity is gone.