


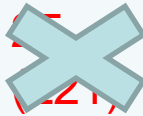



Lecture24: Green's function

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Calendar

- Plan for remaining lectures
 - Two more lectures

Mon	Tue	Wed	Thu	Fri	Sat	Sun
			17	18	19	20
	22		24		26	27
28 (No lecture)	29		Dec.1		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 fluctuation, 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

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

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

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

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