Low level injection approximation

quasi-neutral "p" region

$$\frac{\partial \Delta n}{\partial t} = \mu_n E \frac{\partial \Delta n}{\partial x} + D_n \frac{\partial^2 \Delta n}{\partial x^2} - \frac{\Delta n}{\tau_n}$$

Assume Δn is small
E is small

ignore!

$$\Delta n \cong A(x,t)\,\varepsilon + O(\varepsilon^2)$$
$$E \cong B(x,t)\,\varepsilon + O(\varepsilon^2)$$

(ε is the small-ness parameter)

The above equation becomes

$$\varepsilon \frac{\partial A}{\partial t} \cong \mu_n B \underbrace{\frac{\partial A}{\partial x} \varepsilon^2}_{} + D_n \frac{\partial^2 A}{\partial x^2} \varepsilon - \frac{A}{\tau_n} \varepsilon$$

$O(\varepsilon^2)$ ignored!

We ~~can~~ ignore this! Should!

Match coefficients of $O(\varepsilon)$ terms!

$$\frac{\partial A}{\partial t} = D_n \frac{\partial^2 A}{\partial x^2} - \frac{A}{\tau_n}$$

Equivalent to

$$\frac{\partial \Delta n}{\partial t} = D_n \frac{\partial^2 \Delta n}{\partial x^2} - \frac{\Delta n}{\tau_n} \quad !$$

More Reading
http://griffin.ucsc.edu/teaching/1044-105/A02-Perturbation.pdf