TTT4120 Digital Signal Processing

Problem Set 1

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Contents

Problem 1 - Conductivity

The conductivity of a semiconductor will depend on the doping concentration. Express the conductivity σ as a function of

$$\tilde{n} = \frac{n_0}{n_i}$$

i.e. the electron concentration normalized to the intrinsic value.

The general equation for conductivity due to electron is

$$\sigma = q n_0 \mu_n$$

from the given function we have that

$$n_0 = \tilde{n} \cdot n_i$$

This gives us

$$\sigma = q(\tilde{n} \cdot n_i)\mu_n$$

$$\mu_n \equiv \frac{q\tau}{m_n^*}$$

$$\Rightarrow \sigma = (\tilde{n} \cdot n_i)\frac{q^2\tau}{m_n^*}$$

where q is the charge of an electron, $\tilde{n}$ is the electron concentration normalized to the intrinsic value n_i the intrinsic carrier concentration, μ_n is the electron mobility

is

Part 2: Effective Mass

Part 3: Carrier Concentrations