ΕΠΙΠΕΟ

Fundamentals on coherent optics : linear propagation in optical waveguides

exercice 4 : correction

1) a, $N_g = \frac{L}{t_g}$ and $v_g = \frac{c}{N_g} \Rightarrow \frac{L}{t_g} = \frac{c}{N_g} \Rightarrow \underline{\underline{t_g = \frac{L}{c} N_g}}$

b) $\tau = \left|\frac{dt_g}{d\lambda}\right| \Delta\lambda$

2) $D_m = \frac{\tau}{\Delta\lambda L} = \frac{1}{\Delta\lambda L} \frac{dt_g}{d\lambda} \Delta\lambda = \frac{1}{L} \frac{d}{d\lambda}\left(\frac{L}{c} N_g\right) = \frac{1}{c} \frac{dN_g}{d\lambda}$

or $\frac{dN_g}{d\lambda} = \frac{d}{d\lambda}\left(n - \lambda \frac{dn}{d\lambda}\right) = \frac{dn}{d\lambda} - \lambda \frac{d^2n}{d\lambda^2} - 1 \times \frac{dn}{d\lambda} = -\lambda \frac{d^2n}{d\lambda^2}$

thus $D_m = -\frac{\lambda}{c} \frac{d^2n}{d\lambda^2}$

3) $D_m = -\frac{\lambda}{c} \frac{d^2n_1}{d\lambda^2}$

$\frac{dn_1}{d\lambda} = -K A_1 e^{-\lambda K}$ $\qquad$ $\frac{d^2n_1}{d\lambda^2} = +K^2 A_1 e^{-\lambda K}$

AN: $D_m = -\frac{0,8\ 10^{-6}}{3\ 10^8} \times (1,63\ 10^6)^2 \times 0,0402\ e^{-(0,85 \times 1,63)}$ 4/4

$= -7,6\ 10^{-5}\ s/(m.m) = \underline{\underline{-76\ ps/(nm.km)}}$

4) $D_c = D_m + D_g$ et $|D_c| = \frac{|\tau|}{\Delta\lambda L} = \frac{200}{0,01 \times 100} = 200\ ps/(nm.km)$

if $D_c = -200\ ps/(nm.km) \rightarrow \underline{\underline{D_g = -124\ ps/(nm.km)}}$

if $D_c = +200\ ps/(nm.km) \rightarrow \underline{\underline{D_g = +276\ ps/(nm.km)}}$