Ultrafast Optics, Spring 2022,

Homework 2

Due on April 15th 2022, in class or electronic file sent to TA's email by 23:00 April 15th, 2022

Problem 1:

In fiber optics science, the expression $D = \frac{d}{d\lambda}(\frac{1}{V_g})$ is often used to describe the group velocity dispersion (GVD), where V_g is the group velocity. Derive the relationship between D and $\frac{d^2k}{d\omega^2}$, where $k = \frac{\omega n}{c}$.

Problem 2:

Assuming a Gaussion pulse in the air $E(t) = e^{-\frac{t^2}{t_0^2}}e^{-j\omega_0 t}$, center wavelength at 800nm, where $t_0 = 80e^{-15}s$,

- Use any math software such Matlab to plot the frequency domain signal (spectrum) of the pulse.
- Use above mentioned pulse description, plot the spectrum of the time domain signal which includes two pulses with certain time delay. Use at least two different time delay settings to observe the difference of spectra and give the explanation upon the observations.