An introduction to modelling optical fibre links

The aim of this experiment is to develop a computer model of an optical fibre communications link that includes the effects of attenuation, dispersion and noise. Your model should be able to simulate eye-diagrams and you should use these to assess link performance. **Key result:** for suggested typical system parameters determine whether 1 Gb/s and 10 Gb/s links are limited by attenuation or dispersion, and estimate at what length interval you will need to introduce regenerators for each bitrate.

When designing optical fibre networks it is often convenient to model or simulate the propagation of optical pulses through the complete fibre link to determine the effect of attenuation and dispersion in the fibre and noise in the detector. All three factors effect on the reception of pulses sent down the fibre; attenuation reduces the power of the pulse to a point where it can be lost in the noise and dispersion causes the pulse to broaden so that the signal from neighbouring pulses overlaps. In high data rate optical networks these effects limit the distance that the pulses can propagate over for a given data rate. This exercise is designed to encourage you to investigate these effects, and to study their impact on optical fibre links by writing a simple computer program to model pulse propagation.

You can use any method you wish to write programs to produce the results. But you are encouraged to build on the results of your modelling optical fibres demonstration experiment byusing python. This script is written as a set of assignments, the earlier ones in particular are to help structure your work and help you develop your models, which in the later ones you are expected to produce results. However, do not take this script as a template for your report, which should concentrate instead on the more advanced elements of your study such as actually working out what links would work in practice in assignment 4. And do try to get on to the extension exercises at the end of the script, once you have a working model they should be easy to implement.

Assignment 1 - Dispersion

This assignment is something that you should be able to complete relatively easily based on your demonstration experiment. It is meant as a gentle introduction to get you going and will not provide results that you should include in your report.