Open Optical Networks - The Line System

Exercise 1 - Find Gain for Transparent Mode

1. download from the web portal the following files:
   - eqpt.json
   - default_edfa_config.json
   - utilities.py
2. create a json file with the parameters of your Fiber. This json file has the following parameters:
   - "uid": a string used as unique identifier. You can use the name you want.
   - "params": a structure containing the following parameters:
     - "length": 80 km (length of the fiber)
     - "loss_coef": 0.2 dB/km (attenuation coefficient)
     - "length_units": "km" (this parameter automatically scales the length and the loss coefficient)
     - "att_in": 0 dB (attenuation before the fiber)
     - "con_in": 0.5 dB (loss of the connector at the input of the fiber)
     - "con_out": 0.5 dB (loss of the connector at the output of the fiber)
     - "type_variety": "SSMF"
     - "dispersion": 1.67e-05 s/m^2 (dispersion coefficient)
     - 'gamma': 0.0 W/m (non-linear coefficient)
3. Instantiate the fiber from the JSON file.
4. Instantiate the spectral information.
5. Propagate the WDM comb through the Fiber.
6. Calculate the loss for the channel 45
7. Instantiate the amplifier, as in Exercise 1.4 Lesson 4, in such a way it recovers the loss.
8. Plot the input and output signal power for each channel and verified the are the same.

Exercise 2 - Linear propagation

1. Build a line system composed of 10 span (fiber - amplifier). The line has to be a vector of tuples, each containing a fiber and an amplifier with the configuration of Exercise 1.
2. Propagate the spectral information through the all line elements, saving the output signal information to each span.
3. Use the transiever object to evaluate the GSNR and the OSNR of the sectral information of after each span.
4. Plot the GSNR and the OSNR evolution through the line, span by span, for the channel 45.
5. Plot the GSNR and the OSNR for each channel at the end of the line.

Exercise 3 - Non-Linear propagation

1. Modify the fiber json such as the gamma parameter is 0.00127.
2. Build a line system composed of 10 span (fiber - amplifier). The line has to be a vector of tuples, each containing a fiber and an amplifier with the new configurations.
3. Use the transiever object to evaluate the GSNR, the OSNR and the SNR_{NL} of the sectral information after each span.
4. Plot the SNR, the OSNR and the SNR_{NL} evolution through the line, span by span, for the channel 45.
5. Plot the GSNR and the OSNR for each channel at the end of the line.

Exercise 4 - Optional

1. Decrease by 3 dbm the spectral information power in eqp.json.
2. Build a line system composed of 10 span (fiber - amplifier). The line has to be a vector of tuples, each containing a fiber and an amplifier with the new configurations.
3. Use the transiever object to evaluate the GSNR, the OSNR and the SNR_{NL} of the sectral information after each span.
4. Plot the SNR, the OSNR and the SNR_{NL} evolution through the line, span by span, for the channel 45.
5. Describe how the new input power affects the generation of P_{ASE} and P_{NLI} observing the new evolutions of the GSNR, the OSNR and the SNR_{NL}