Simulink Test-bed
Advanced Photonic Systems Simulator
Version 1.0

Operational Instructions

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Blocks in Simulator

1 TRANSMITTERS (RZ-DQPSK)

Assumption:

- Dual drive MZM → No chirp
- RZ-DQPSK
- Pre-coder I-data and Q-data for DQPSK transmission

2 FIBRE PROPAGATION

- Fibre propagation with non-linear Schrodinger equation is numerically solved by Split-Step Fourier Method (SSFM).
- Fibre parameters can be varied from the initial files or from the mask of the block (this feature will appear in the updated version)
- **Checking for the MAXIMUM average input power to avoid the case of VERY HIGH NON-LINEAR EFFECTS, HENCE COMPLETELY DESTROY SIGNALS (the default value is set to be 25 dBm)**

3 RECEIVER

- Implementation of Balanced Receiver with Mach-Zender Delay Interferometer (MZDI) for DQPSK

Assumption:

- Ideal MZDI: without imperfection of MZDI.

4 EDFA

Parameters:

- Gain
- Noise Figure
- Minimum power threshold for operation of EDFA
- Random seed number for AWGN.

❖ ***These parameters can be varied from the pop-up mask in the model***.

Assumptions:

- EDFA is operating in saturation region with high optical gain.

5 DEMODULATED BINARY SIGNALS AND ERROR CALCULATION

- **BER blocks are used to show the BER (provided the DELAY is set correct)**

6 MONITORING

- Showing EYE DIAGRAMS (including PERSISTENT mode)

OPERATIONAL INSTRUCTIONS

1. Open the Simulink model .mdl

2. The initial file is automatically run. The parameters in the initial files can be varied according to the specifications of the experiment. The initial file containing critical parameters of system and standard single mode fibre (SSMF). The significant parameters are:

    - Signal pulse width, thus the Bit Rate
    - Baud Rate
    - Signal peak power
    - Number samples per bit (normally 8,16 or 32)
    - Length of Fast Fourier Transform
    - PRBS length.
    - Sampling time.
    - Step size for FFSM (dz)
    - Number of step sizes (nz) → Length of fibre span = dz * nz
    - Dispersion, Dispersion Slope
    - Non-linear coefficient (γ)
    - Non-linear power threshold
    - Attenuation of the fibre
    - Effective Area
    - Refractive index

    The Dispersion Compensating Fibre (DCF) right now is used with the same configuration of SSMF but **NEGATIVE** dispersion factors. The updated version of the simulator will include a separate configuration set of parameters for DCF (these parameters can be obtained from commercial DCFs)

3. Number of bits run in simulation can be set in the ***"SIMULATION STOP CONTROL"*** block.

4. Scopes and Eye Diagrams have been developed for convenience of observation of the results. **They need to be "AUTO SCALE" to obtain the best reading.**

5. **DQPSK detections need to be correct for both I and Q-data.**

NOTES: **The simulation will stop in the following scenarios:**

- **Reaching the set number of bits run for Simulation.**
- **The average signal power into EDFA is SMALLER than the power threshold**
- **The average signal power into the fibre is LARGER than the max power threshold to avoid the complete distortion of lightwave caused by VERY HIGH NON-LINEAR EFFECTS -→ The GAIN of EDFA needs to be set at a proper value.**