ScuDo

Scuola di Dottorato ~ Doctoral School

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XXXIV Cycle

Coherent Detection for Short Reach Optical Transmission System

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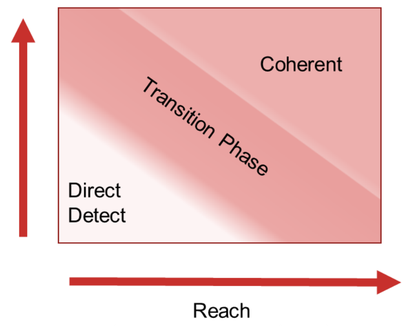
Research context and motivation

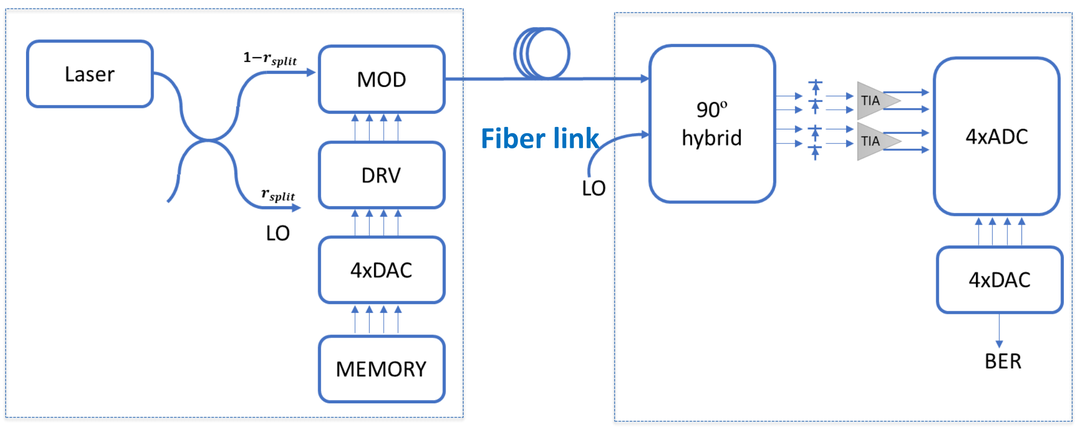
- Short reach coherent transmission systems bring high bitrates, high spectral efficiencies and exceptional sensitivity in emergent applications such as Remote physical Layer for cable access, 5G backhaul, and unamplified interfaces.
- Higher performance coherent optical interfaces allow longer reaches without needing reinforcement, which ultimately lowers the cost of deploying and managing these networks.



- Emerging applications such as Remote PHY for cable access, 5G backhaul, and unamplified “ZR” interfaces are growing as standards, all the efforts and deployment strategies are still in the early stage.
- The use of Digital Signal Processing (DSP) chip with reduced power consumption for short reach and integrated coherent optics will be available soon permitting the implementation shorter reach applications benefiting from initial long-haul technology investment that is the final goal.

Addressed research questions/problems

- With the ever increasing demand in transporting, routing and switching high-bandwidth data, modern telecommunication, optical coherent technology is moving to shorter reach as data rates increase.
- The reference setup for coherent systems is reported in the figure below.



- The architecture at the transmission part is similar as the used in long haul coherent systems. The setup consist on a coherent transmitter, a transmission fiber without any amplification and an integrated coherent receiver (ICR).
- Specifically, we are planning to study a self-coherent system in which:
  - At the transmitter the laser power is split with a variable ratio r_{split} providing the carrier to be modulated for the outbound signal and the local oscillator (LO) to beat with the inbound signal.
  - It is important to calculate the system power budget in the signal path that will be determined by r_{split} , the insertion loss of the modulator and by the attenuation of the fiber link.

Submitted and published works

- R. Gaudino , G. Arevalo, and M. Tipán, “*Techno-Economics for Optimal Deployment of Optical Fronthauling for 5G in Large Urban Areas* ”, International Conference on Transparent Optical Networks, 2018, pp. 1-4

Novel contributions

- During the first year, I have prepared myself by taking the lectures that are related to the Topic taken and trained myself on digital signal processing
- I thus not have yet novel contributions, which are expected to come anyway in the second year.

Adopted methodologies

- I trained myself to use different DSP-based equalizations methods using MATLAB code.
- Simulation of different communications systems in MATLAB.
- Calculation of several factors involved in the design of coherent receiver, optical front end for unamplified applications.

Future work

- Verification of several factors that will affect the design of coherent receiver, optical front end for unamplified Optical Transmission System.
- Through the implementation of equalization strategies obtain first results of the performance of the system.
- Once identified the points to solve in order to reach high Data Rates, apply advanced equalization techniques obtaining new results and compare those with the one from the fist step.
- Implement an experimental part and compare the results obtained with simulations.

List of attended classes

- 01QWIBG – Devices for optical and microwave communications (18/7/2019, 6)
- 01NDLRV – Lingua Italiana I livello (18/06/2019, 3)
- 01TCTRV – Photonext: Hands on course on Photonics for Fiber Transmission (13/09/2019, 6)
- 01QFDRV – Photonics: a key enabling technology for engineering applications (24/07/2019, 5)
- 01RISRV – Public speaking (01/09/2019, credits)

POLITECNICO DI TORINO

PhD program in

Electrical, Electronics and Communications Engineering