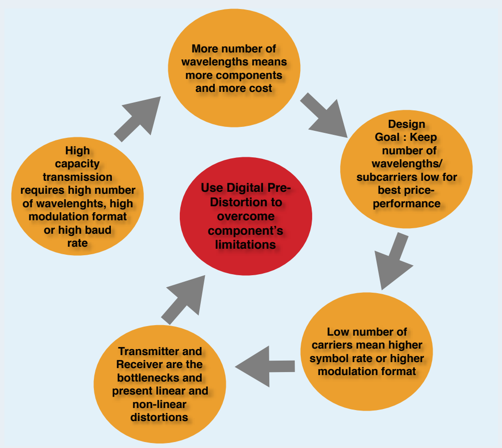
A Robust Adaptive Digital Pre-Distortion Method for Optical Communication Transmitters

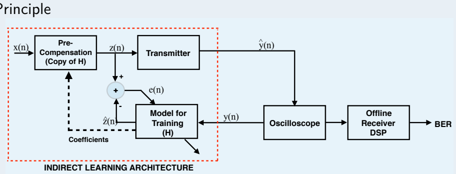
G. Khanna, B. Spinnler, S. Calabrò, E. De Man, N. Hanik
ginni.khanna@tum.de

Motivation



Proposed Solution : Adaptive Digital Pre-Distortion

- Principle



$$y_i(n) = \sum_{p=1}^{P} \sum_{m=-(M-1)/2}^{(M+1)/2} h_{i,m,p} x_i^p(n-m), \quad (1)$$

- Non-Linear Volterra model allows to compensate for:
  - Linear distortions
  - Non-Linear distortions
  - Skew between tributaries
- Adaptive implementation of the proposed algorithm renders individual measurement of transmitter component obsolete.
- Initial implementation in electrical back-to-back scenario (Digital Pre-Compensation)
- Extension of algorithm to compensate for electrical and optical effects in the trasmitter

Adaptive Digital Pre-Compensation: Electrical Back-To-Back Scenario

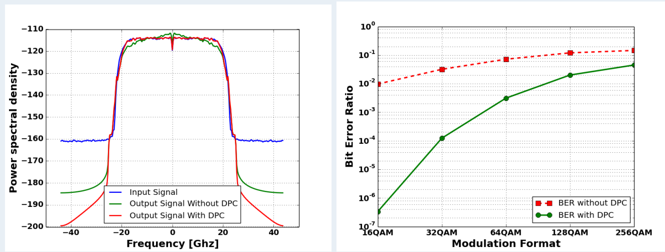


Figure 1: (a) Power Spectral Density for 256-QAM 37.41Baud Signal (b) B2B measurements

Adaptive Digital Pre-Distortion: Optical Back-to-Back Measurements

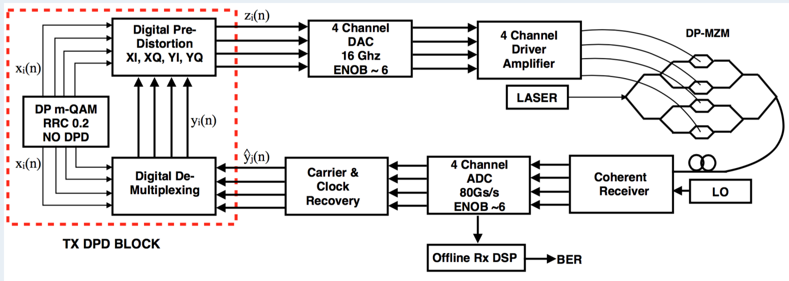


Figure 2: Experimental Setup : Optical Back-to-Back

Experimental Results

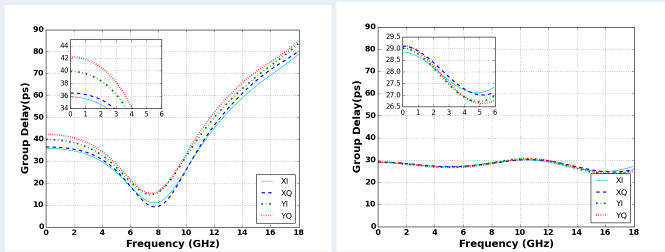


Figure 3: (a) TX I/Q skew without DPD (b) TX I/Q skew with DPD

Experimental Results

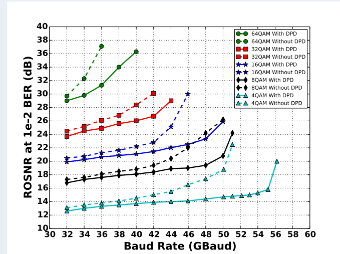


Figure 4: Effect of DPD on DP-4QAM, DP-8QAM, DP-16QAM, DP-32QAM and DP-64QAM

Digital Pre-Distortion enables symbol rates up to 56 GHz with state-of-the-art 30 GBaud components

Conclusion and Future Work

- A new robust method for digital pre-distortion of various linear and non-linear effects of optical communication transmitters using a truncated Volterra series and indirect learning architecture with least squares optimization is presented.
- The proposed method is device independent and a simple software DSP solution.
- Future Work : Implementation of the algorithm with highly non-linear transmitters

References

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