Single-step digital backpropagation for nonlinearity mitigation - DTU Orbit (08/12/2018)

Single-step digital backpropagation for nonlinearity mitigation
Nonlinearity mitigation based on the enhanced split-step Fourier method (ESSFM) for the implementation of low-complexity digital backpropagation (DBP) is investigated and experimentally demonstrated. After reviewing the main computational aspects of DBP and of the conventional split-step Fourier method (SSFM), the ESSFM for dual-polarization signals is introduced. Computational complexity, latency, and power consumption of DBP based on the SSFM and ESSFM algorithms are estimated and compared. Effective low-complexity nonlinearity mitigation in a 112 Gb/s polarization-multiplexed QPSK system is experimentally demonstrated by using a single-step DBP based on the ESSFM. The proposed DBP implementation requires only a single step of the ESSFM algorithm to achieve a transmission distance of 3200 km over a dispersion-unmanaged link. In comparison, a conventional DBP implementation requires 20 steps of the SSFM algorithm to achieve the same performance. An analysis of the computational complexity and structure of the two algorithms reveals that the overall complexity and power consumption of DBP are reduced by a factor of 16 with respect to a conventional implementation, while the computation time is reduced by a factor of 20. Similar complexity reductions can be obtained at longer distances if higher error probabilities are acceptable. The results indicate that the proposed algorithm enables a practical and effective implementation of DBP in real-time optical receivers, with only a moderate increase in the computational complexity, power consumption, and latency with respect to a simple feed-forward equalizer for bulk dispersion compensation.

General information
State: Published
Organisations: Department of Photonics Engineering, Metro-Access and Short Range Systems, CNIT, Sant'Anna School of Advanced Studies
Contributors: Secondini, M., Rommel, S., Meloni, G., Fresi, F., Forestieri, E., Potì, L.
Number of pages: 10
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Photonic Network Communications
Volume: 31
Issue number: 3
ISSN (Print): 1387-974X
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 1.26 SJR 0.623 SNIP 0.557
Web of Science (2017): Impact factor 1.203
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 1.08 SJR 0.249 SNIP 0.636
Web of Science (2016): Impact factor 1.21
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 1.09 SJR 0.256 SNIP 0.661
Web of Science (2015): Impact factor 0.557
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 1.03 SJR 0.261 SNIP 0.689
Web of Science (2014): Impact factor 0.793
Scopus rating (2013): CiteScore 1.05 SJR 0.286 SNIP 0.713
Web of Science (2013): Impact factor 0.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Scopus rating (2012): CiteScore 0.79 SJR 0.253 SNIP 0.638
Web of Science (2012): Impact factor 0.448
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): CiteScore 0.78 SJR 0.247 SNIP 0.724
Web of Science (2011): Impact factor 0.485
ISI indexed (2011): ISI indexed yes
Scopus rating (2010): SJR 0.258 SNIP 0.975
Web of Science (2010): Impact factor 0.6
Web of Science (2010): Indexed yes
Scopus rating (2009): SJR 0.305 SNIP 0.801