Mohammad A Z Al-Khateeb et al., J Laser Opt Photonics 2017, 4:4 (Suppl)
DOI: 10.4172/2469-410X-C1-017

Nonlinearity compensation using optical phase conjugation in optical fiber transmission systems

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The fundamental performance limits of coherent optical transmission systems can be observed by a simple optimization between the linear noise and the nonlinear noise generated within the system. Optical Phase Conjugation (OPC) is considered to be one of the promising techniques to compensate for optical fiber's dispersion and nonlinearity that cause crosstalk between signals traveling through long-haul optical transmission systems, nonlinearity compensation can lead to significant information capacity and distance reach expansion of optical fiber transmission links. To get the full benefit from the deployment of OPC in optical transmission systems, a few considerations must be taken into account, such as: power profile symmetry, fiber's dispersion slope and Polarization Mode Dispersion (PMD). In this contribution, we will present our simplified theoretical predictions of optical fiber transmission systems performance that deploy mid-link OPC and multi-OPC and we will show that the introduction of multi-OPC in an optical transmission system will minimize the impact of uncompensated/nondeterministic signal-signal nonlinear interactions due to fiber's PMD and signal-noise interactions. We will show wide range of simulation and experimental results that validate the theoretical predictions of system's performance for various types of links: dispersion managed, dispersion unmanaged, discretely amplified systems and distributed Raman amplified systems. Also, we will present an extensive experimental study shows that the deployment of mid-link OPC can provide a significant reach improvement in asymmetric lumped optical fiber links when optimizing the span length.

Biography

Mohammad A Z Al-Khateeb has received his BSc in Communication and Software Engineering from Balqa' Applied University, Jordan. Then he received his MSc degrees in Photonics Networks Engineering, Erasmus Mundus double Master's degree, from Scuola Superiore Sant'Anna and Aston University. He is currently working towards PhD degree from Aston University under the supervision of Prof. Andrew Ellis. He is currently working across multiple projects, participated in organizing outreach activities such as LightFest (an International Year of Light event in Birmingham) and he is working on industrial contracts. He has authored/co-authored over 12 publications and he is leading the development of theoretical tools and experimental demonstrations to exhibit the benefits of Optical Phase Conjugation in optical communication systems.

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