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Mitigating transmitter non-linearity and fiber impairments in radio over fiber technology

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Single mode fibers are typically used in WAN, MAN and also find applications in radio over fiber (RoF) architectures supporting data transmission in fiber to the home (FTTH), remote antenna units (RAUs), etc. Multi-mode fibers (MMFs) with low cost, ease of installation and low maintenance are predominantly (85% to 90%) deployed in in-building networks providing data access in LANs. The transmission of MMW signals through the SMF in WAN and MAN, along with the reuse of MMF in in-building networks will not levy fiber reinstallation cost. The transmission of the millimeter waves experiences signal impairments due to the transmitter non-linearity and modal dispersion of the MMF. The MMF exhibiting large modal dispersion limits the bandwidth-length product of the fiber. The second and higher-order harmonics present in the optical signal fall within the system bandwidth. This causes an unwanted radiation of power at the RAU. The power of these harmonics is proportional to the non-linearity of the transmitter and the modal dispersion of the MMF. In this research work, a mathematical model is developed for Second-order Harmonic Distortion (HD2) generated due to non-linearity of the transmitter and chromatic - modal dispersion of the SMF-MMF. The model consists of a MZM that generates two *m*-QAM OFDM Single Sideband (SSB) signals based on phase shift of the hybrid coupler (90° and 120°). Our results show that the SSB signal with 120° hybrid coupler suppresses the higher-order harmonics and makes the system more robust against the HD2 in the SMF-MMF optic link.

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Management of rogue waves dynamics generated by higher order dispersion effects in a left-handed transmission line

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Optical rogue waves are rare yet extreme fluctuations in the value of an optical field. The terminology was first used in the context of an analogy between pulse propagation in optical fiber and wave group propagation on deep water, but has since been generalized to describe many other processes in optics. In this communication, we analyze the propagation of an electromagnetic wave in left-handed material and where cubic nonlinearity, second, third and fourth order dispersion effects are taken into account. The wave behavior is modeled by nonlinear Schrödinger equation. Thereafter, the light pulse intensity profile is characterized by collective coordinate's technique from the use of a Gaussian Ansatz function. One frequency range has been outlined to investigate the wave behavior. The robust soliton light pulse is obtained with a perfect self-compensation between second-order dispersion and cubic nonlinearity. We demonstrate that weak nonlinearity acting with second and third-order dispersion effects can provoke appearance of a random rogue wave's field. If the frequency increases in this frequency range selected, the weak nonlinearity induces a classical modulational instability, leading to a train of rogue wave field. Each of this train can be identified as Kuznetsov–Ma waves train. Moreover, if fourth-order dispersion comes into play, the soliton light pulse is restored. The rogue wave mechanisms of generation are also discussed.

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