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Method to code the signal amplitude by folding and auxiliary information labels

A simple technique improves the power budget of cost-effective optical analog and OFDM systems by transmitting the signal absolute value and adding a label with the sample sign or region.

The Challenge

Broadband communication networks are nowadays based on optical fiber transmission, where the data signals are transported over a modulated optical carrier. For this, typically an optical modulator is used at the transmitter and the received power signal is photo-detected at the receiver. However, the modulation is non linear generally. For example, the Mach-Zehnder modulator (MZM) has a periodical sinusoidal input-output function, and the photo-detector is unipolar, not being sensible to the optical signal phase.

This non-linearity is especially affecting negatively in analog (SCM, OFDM, RadioOverFiber) systems, requiring that the signal is unipolar, while the analog signals are bipolar. For this requirement, typically a large DC bias offset is added to the signal and the modulation index is highly lowered with respect to digital transmission. This involves a high mean optical power with low modulation depth and high PAPR, so thus a very limited transmission performances in terms of distance reach and power budget.

The Technology

The technique proposed produces an unipolar analog signal without adding a DC bias. It consists on separating the original signal into two parts: the magnitude and a sign label. The bipolar signal passes through a null-level threshold where its sign is extracted, and only its absolute value is considered afterwards. The electrical signal including both magnitude and sign can then be modulated without the need of DC bias and with low PAPR.

This folding operation is also extended to any non-linear region of the modulator, like the multiple periods of the MZM, assigning a label to each one. With this, the modulation depth can be highly increased and, consequently, the signal to noise ratio at the receiver and the link length.

Innovative advantages

- Linearization of the non-linear optical modulation function by labeling each modulator stretch or period
- Increased power budget and length of the fiber link
- Low PAPR OFDM transmission
- Enables the use of non-linear modulators
- Specially suited for OFDM, SCM and Radio-over-Fiber systems

Current stage of development

Prototype and validity tests passed. Experimental results published at: 38th European Conference on Optical Communication (ECOC), paper P6.04 , 2012, Amsterdam.

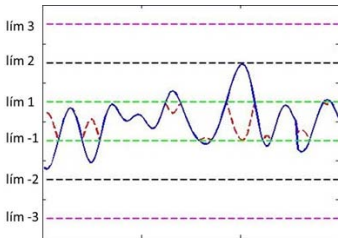
Applications and Target Market

- Broadband Telecom System Vendors
- Broadband wired and wireless Operators
- Manufacturers of lasers, modulators and drivers
- Broadband Optical Communications networks: access, metropolitan, transport
- Remote antenna feeding
- Next Generation - Passive Optical Networks (NG-PON), based on OFDM or SCM.

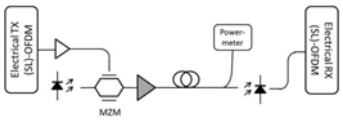
Reference number

MKT2012/0140_I

ANALOG & OFDM OPTICAL FIBER COMMUNICATIONS



OVERCOMING THE OPTICAL MODULATOR NON-LINEARITY



1. **Fold the signal at specific threshold/s**
2. **Assign label to each**
3. **Transmit with low PAPR**
4. **De-fold at the receiver**

Business Opportunity
Technology available for licensing, transfering and technical cooperation

Patent Status
Priority application

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