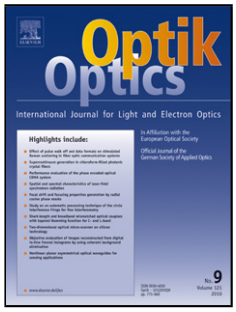

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Improved high gain circuit and DFE algorithm for underwater optical communication

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Abstract: Underwater long-distance optical communications, due to the influence of light scattering and absorption, it will cause severe signal attenuation, in addition, multipath propagation effects and Doppler effect of light will cause serious signal distortion. Based on the problems, an improved amplifier with Direct Current (DC) servo loop is proposed. The amplifier overcomes the shortcoming of conventional amplifiers and has high gain, wide dynamic range. Further, in order to overcome the time varying interference, an improved decision feedback equalizer (DFE) model and algorithm is given, the model can achieve faster convergence and smaller steady-state error. The new algorithms take Marr function as a basic function, and two parameters α and β used to shape the profile of functions. Experiments show that the method can greatly improve the transmission distance of underwater optical communications (UOC)

Keywords: UOC,DC offset, amplifier, DFE algorithm

1 Introduction

The scattering and the absorption of UOC will cause the light signal serious attenuation. The absorption of light energy is

$$d\emptyset_a = -a * \emptyset_0 . dr \qquad (1)$$

$\emptyset_a$ is the absorption of energy, a is the absorption coefficient. After conversion,

$$\emptyset = \emptyset_0 . e^{-ar} \qquad (2)$$

Further, since the light scattering and diffraction effects, the receiver can only receive a portion of the light,

$$Aff_{geometric} = \frac{S_d}{S_{capture}} = (d\theta)^2 \frac{\pi}{4} / S_{capture} \qquad (3)$$

θ is the beam divergence angle, *d* is the distance between the transmitter and receiver. When the scattered light to return the receiving end, it will result in multipath interference and cause serious signal distortion at the receiving end.

The dispread signal $I(t)$ is given by.

$$I(t) = \sum_j s_j \, vT(t + jT) \qquad (4)$$