

## 论文

### 40 Gbit/s 相干偏振复用QPSK传输中基于Manakov方程的非线性补偿

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#### 摘要:

在40 Gbit/s相干偏振复用正交相移键控(QPSK)传输系统中,为了补偿由于光纤中非线性效应引起的传输信号损伤,采用了基于Manakov方程的反向传播非线性补偿算法.传统的基于标量非线性薛定谔方程(NLSE)的反向传播算法忽略了偏振模色散(PMD)的作用,因此在偏振复用系统中不能补偿由于PMD引起的信号损伤.而基于Manakov方程的数字信号处理方法能够对PMD与克尔非线性效应的耦合作用进行补偿.从仿真与实验两个方面对此方法在40 Gbit/s相干偏振复用QPSK传输系统中的补偿效果进行了验证.结果均表明,与NLSE相比,基于Manakov方程的反向传播算法在400 km长距离QPSK传输中显示出更好的性能.在光信噪比(OSNR)为18 dB时,基于Manakov方程的反向传播算法得到的Q值与NLSE相比提高约3dB.

**关键词:** 正交相移键控 非线性补偿 Manakov方程

### Nonlinear Compensation Based on Manakov Equation for Coherent 40Gbit/s Polarization-Multiplexed QPSK Transmission

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#### Abstract:

A digital signal processing (DSP) algorithm,nonlinear compensation based on Manakov equation,was applied in coherent 40Gbit/s polarization-division multiplexing quadrature phase-shift keying (PDM-QPSK) transmission systems to compensate the nonlinear impairment in optical fiber.The back propagation algorithm based on Manakov equation can reduce the interaction between nonlinear impairment caused by Kerr effect and polarization mode dispersion (PMD) while the traditional back propagation based on scalar nonlinear Schrödinger equation (NLSE) neglects the PMD and cannot compensate the impairment caused by PMD in the polarization-division multiplexing transmission systems.The performance of nonlinear compensation based on Manakov equation was verified.Both simulation and experimental results show that the Manakov equation based algorithm exhibits better performance of 400 km-long QPSK transmission comparing with NLSE,with a Q-factor improvement of approximately 3 dB at an OSNR of 18 dB.

**Keywords:** Quadrature phase-shift keying Nonlinear compensation Manakov equation

**收稿日期** 2010-11-24 **修回日期** 2011-03-14 **网络版发布日期** 2011-06-25

DOI: 10.3788/gzxb20114006.0883

#### 基金项目:

国家自然科学基金;国家自然科学基金

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