

## 论文

### 基于MMSE的大气激光通信中LDPC码BP译码算法研究

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#### 摘要:

针对大气激光通信中低密度奇偶校验码(LDPC)置信传播(BP)译码算法复杂度高的问题,对几类BP-Based简化译码算法进行了分析,并基于最小均方误差准则(MMSE)对Scaled BP-Based和Offset BP-Based两类改进译码算法的优化设计进行了探讨,得出两类算法的最优校正因子,并给出了数值计算.在不同的湍流强度下,对码长1008的(6,3)比特填充LDPC码进行了仿真实验,结果表明,对于短码长的LDPC码,当译码BER=10<sup>-5</sup>时,最小和算法(UMP BP-Based)相对于BP算法有0.1~0.15 dB的译码性能损失;基于MMSE设计的两类算法相比BP算法大大降低复杂度的同时,译码性能与BP算法相当,甚至优于BP算法,优于UMP BP-Based算法0.075~0.15 dB.

关键词: 大气激光通信 低密度奇偶校验码 最小均方误差准则 改进的置信度传播算法

### Optimization of Two BP-based Decoding Algorithms for LDPC Codes Based on MMSE Criterion under Weak Turbulence Channel

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#### Abstract:

Due to high complexity of Belief Propagation(BP) algorithm, several kind of BP-based simplified decoding algorithms are analyzed. Based on the Minimum Mean Square Error(MMSE) criterion, optimal design of the scaled BP-based and offset BP-based algorithms is discussed. The theoretical formulas and numerical calculations on the optimal factors for these two BP-based algorithms are provided. The simulation results for the (6,3)regular LDPC codes of lengths 1008 on the weak atmospheric turbulence channel demonstrate that the scaled BP-based and offset BP-based algorithms with the proposed factors are better than Min-Sum Algorithm, and even can achieve the performance better than that of the BP algorithm, and have lower complexity compared with BP algorithm.

Keywords: Free space laser communication LDPC codes MMSE criterion Improved BP algorithms

收稿日期 2011-07-20 修回日期 2011-12-15 网络版发布日期

DOI: 10.3788/gzxb20124103.0277

#### 基金项目:

国家自然科学基金(No.60902017)、安徽省自然科学基金(No.10040606Q60、No.10040606Q61)资助

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