亮点报道：最优直接检测接收机

DOI: 10.12086/oee.2026.261002.h03

ESE (ESE=数据率/接收机电带宽) 是直接决定短距离传输系统成本的主要因素。此外，由于缺少光场重构能力，无法使用数字信号处理 (DSP) 算法进行光纤色散补偿，这将限制系统可实现的 ESE。因此，有必要研究具有光场重构能力的高 ESE 复值双边带 (CV-DSB) 直接检测方案。

上海交通大学苏翼凯教授团队联合诸葛群碧副教授、西湖大学 William Shieh 教授和美国诺基亚贝尔实验室 Haoshuo Chen 博士，从传统的相位分集零差相干接收机结构出发，推导出了最优的直接检测接收机架构。该接收机由一个耦合器、两个单端光电探测器 (PD)、两个模数转换器和一个具有最优传递函数的频率选择性相移器组成。通过联合考虑噪声和信号与信号二阶拍频项 (SSBI) 对系统性能的影响，最优的传递函数表现为全通的幅度响应，相位响应表现为对载波或信息承载信号施加可调的相移。在实际应用中，需要根据系统工作条件灵活选择合适的相移。在接收端 DSP 中，使用卷积神经网络一步完成信号重构和 SSBI 消除，从而最优化系统的误码率 (BER) 性能。

所提出的最优直接检测接收机可以为大容量和成本高效的数据中心互连、城域网和移动回传中的一些新应用提供可能。

Opto-Electronic Science, 2025, **4**(2): 240020.
https://www.oejournal.org/article/doi/10.29026/oes.2025.240020

Highlights: Direct detection with an optimal transfer function: Toward the electrical spectral efficiency of coherent homodyne detection

DOI: 10.12086/oee.2026.261002.h03

Electrical spectral efficiency (ESE=Data rate/Receiver electrical bandwidth) is the dictating factor that determines the cost of short-reach transmission systems. Additionally, various impairments cannot be digitally compensated owing to the lack of field recovery capability, which significantly limits the attainable ESE. Consequently, it is worthwhile to investigate the complex-valued double-sideband (CV-DSB) DD schemes with capability of field recovery and high ESE.

A research team including Dr. Xingfeng Li, Prof. Yikai Su, and associate Prof. Qunbi Zhuge from Shanghai Jiao Tong University, Prof. William Shieh from Westlake University, and Dr. Haoshuo Chen from Nokia Bell Labs derived an optimal DD receiver architecture comprising a coupler, two single-ended photodiodes (PDs), two analog-to-digital converters (ADCs), and a frequency-selective phase shifter with an optimal transfer function. By considering the impact of both noise and signal-to-signal beat interference (SSBI) on system performance, the optimal transfer function exhibits an all-pass amplitude response accompanied by a phase response that introduces an adjustable phase shift on either the carrier or the information-bearing signal.

The authors believe that the proposed DD receiver with an optimal transfer function may pave the way for new applications in large-capacity and cost-effective data center interconnections, metro networks, and mobile backhauls.

英文报道摘自 https://www.eurekalert.org/news-releases/1070654