缩略词

ACO-OFDM	Asymmetrically-clipped optical OFDM	非对称光 OFDM 调制
APD	Avalanche Photo Diode	雪崩型光电二极管
BA	BER Adaptive	最小误比特率准则
BER	Bit Error Rate	误比特率
CCDF	Complementary Cumulative Distribution Function	互补累积分布函数
CIR	Channel Impose Response	信道冲激响应
CP	Cyclic Prefix	循环前缀
CSI	Channel State Information	信道状态信息
DCO-OFDM	DC-biased optical OFDM	直流偏置光 OFDM 调制
DD	Direct Detection	直接检测
DMT	Discrete Multi-Tone	离散多音调制
DOW	Diffuse Optical Channel	漫反射光信道
DSL	Digital Subscriber Line	数字用户线路
EVM	Error Vector Magnitude	误差向量幅度
FOV	Field of View	接收机视场角
FPGA	Field Programmable Gate Array	现场可编程门阵列
IEEE	Institute of Electrical and Electronics Engineers	美国电子电气工程师协会
IFFT	Inverse Fast Fourier Transform	逆傅里叶变换
IM	Intensity Modulation	强度调制
ISI	Inter Symbol Interference	符号间干扰
LD	Laser Diode	激光二极管
LED	Light Emitting Diode	发光二极管
LMMSE	Linear Minimum Mean Square Error	线性最小均方误差准则
LOS	Light of Sight	直达径
LS	Least Square	最小二乘法准则
MA	Margin Adaptive	最小发射功率准则
MMSE	Minimum Mean Square Error	最小均方误差估计准则
MSE	Mean Square Error	均方误差
NSF	National science foundation	美国国家科学基金会
OFDM	Orthogonal Frequency Division Modulation	正交频分复用调制
OOK-RZ	On-Off Keying Return-to-Zero	归零开关键控

PAPR	Peak to Average Power Ratio	峰均比
PD	Photo Diode	光电二极管
PN Seq.	Pseudo-Noise Sequence	伪随机序列
QAM	Quadrature amplitude modulation	正交幅度调制
RA	Rate Adaptive	最大速率准则
SBLA	Simple Blockwise Loading Algorithm	简单分组分配算法
SNR	Signal Noise Ratio	信噪比
SVD	Singular Value Decomposition	奇异值分解
VLC	Visible Light Communication	可见光通信
VLCC	Visible Light communication consortium	可见光通信协会
WDM	Wavelength Division Multiplexing	波分复用
WPAN	Wireless Personal Area Network	无线私域网
ZC Seq.	Zadoff-Chu Sequence	ZC 序列

第 1 章　可见光多波段自适应通信系统硬件设计

1.1 引言

我们在前面四章介绍了可见光通信的基本原理及关键技术，特别针对自适应传输这个核心重点研究了信道估计及比特功率分配算法，并且针对本课题对应的硬件平台的实际情况进行了别要的仿真，选出了合适的技术方案，如使用低复杂度的 LS 算法进行信道估计、使用高精度的 EVM 方法进行信噪比估计、使用专为可见光通信设计的 Improved-SBLA 比特功率分配算法得到自适应参数。本章将对可见光通信的硬件系统做一个简要的介绍，还将概述自适应模块的逻辑设计。

1.2 硬件系统概述

本课题对应的硬件演示平台如图 1 所示，该系统目前已经实现了“编译级”的自适应传输，所谓“编译级”就是代码支持通过改变调制参数然后需要再编译来实现调制的改变，而真正的自适应传输系统因为时间紧迫及反向链路方案尚未确定等因素没有完成。不过本系统已有了自适应传输的雏形了，只是信道估计、计算自适应参数、改变调制等需要离线进行，下面对该系统进行概述。

首先信源比特通过以太网接口（UDP 协议）按帧发送到用于基带处理的 FPGA 芯片（整个传输过程都是按帧进行的，并且用于同步和信道估计的 ZC 序列符号只在帧头处放置，整个帧中所有的 OFDM 符号都使用这个 ZC 序列估计出来的信道参数解调），接着在 FPGA 中完成扰码、信道编码、调制和 IFFT 等数字处理过程，然后将时域数字信号输入到数字模拟变换器（Digital to Analogue Converter，DAC）变成模拟信号，最后该模拟信号加上偏置电流之后去驱动 LED 灯，整个发射过程完成。接收端通过 PD 接收 LED 光信号，并将光信号强弱的变化转换成电信号的大小，然后将此模拟电信号送入模拟/数字变换器（Analog to Digital Converter，ADC）中抽样量化为数字信号，再送到接收端基带处理 FPGA 进行解调、解码和校验等操作，最后输出接收到的帧到接收端计算机。

1.3 自适应模块 FPGA 方案设计

1.4 本章小结

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