

DESIGN AND CHARACTERIZING OF OPTICAL CARRIER RECOVERY SCHEME

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Declaration

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Abstract

The field of optical communication has gained rapid development throughout the past years. With the exponentially increasing demand for the internet, the existing transmission bandwidth of fiber optic communication has become insufficient to meet up with end-user requirements. Hence, it is necessary to increase the data rate while enhancing the quality of optical communication systems. Due to the unavailability of high-speed electronics, typical intensity modulation is hard to improve further. One future proof option is to use phase modulated schemes or a combination of phase and amplitude modulation schemes. In this scenario, simultaneous amplitude and phase regeneration schemes are implemented thus making phase synchronization a major concern during the regeneration process. This research is intended to extract the carrier signal phase using the principle of four wave mixing (FWM) and to implement a successful optical carrier recovery scheme. The noise influences from the signal laser for the recovered carrier have been investigated both theoretically and experimentally. Also, the dispersion effects have been analyzed experimentally.

Index terms— Optical fiber communication, carrier recovery, Four Wave Mixing, linewidth, Signal to Noise ratio, binary phase shift keying.

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List of Abbreviations

Abbreviation	Description
ASK	Amplitude shift keying
PSK	Phase shift keying
FWM	Four wave mixing
HNLF	Highly non-linear fiber
OSNR	Optical signal to noise ratio
BPSK	Binary phase shift keying
WDM	Wavelength division multiplexing
EDFA	Erbium doped fiber amplifier
LED	Light-emitting diode
LASER	Light amplification by stimulated emission of radiation
FSK	Frequency shift keying
MZM	Mach Zehender modulator
BFSK	Binary frequency shift keying
MFSK	Multilevel frequency shift keying
DPSK	Differential phase shift keying
QPSK	quadrature phase shift keying
FWHM	Full width at half maximum
OSA	Optical signal analyzer
ESA	Electrical signal analyzer
SPM	Self phase modulation
CPM	Cross phase modulation
SRS	Stimulated raman scattering
SBS	Stimulated brillouin scattering
PLL	Phase lock loop
VCO	Voltage controlled oscillator
IL	Injection locking
OSNR	Optical signal to noise ratio
BER	Bit error rate
ISI	Inter symbol interference

ADC	Analog-to-digital converters
OEO	Optical electrical optical
PSA	Phase sensitive amplifier
NMZI	Nonlinear Mach-Zehnder interferometer
NOLM	Nonlinear optical loop mirror
QAM	Quadrature amplitude modulation
SOA	Semiconductor optical amplifiers
SNR	Signal to noise ratio
ASE	Amplified spontaneous emission
AM	Amplitude modulation
PM	Phase modulation
PBRs	Pseudo random bit sequence
ZDW	Zero dispersion wavelength
SMF	Signal mode fiber
LO	Local Oscillator