

OPTICAL INJECTION LOCKING AND CHARACTERIZATION FOR OPTICAL COMMUNICATION

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Declaration

I declare that this is my work, and this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or institute of higher learning, and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Abstract

The rise of demand for mobile and broadband communication has caused a worldwide requirement of sophisticated transmitters. High volume and low-cost manufacturing of semiconductor optoelectronic devices are playing an integral role in allowing for the deployment of high-speed communication links. Requirements of side mode suppression, reducing nonlinearities, reducing relative intensity noises and chirps, enhancing the bandwidth are key parameters that are leading for the enhancement of quality and the performance of fiber optic communication system. Optical injection locking (OIL) is one technique to overcome these limitations arising in developing better optical transmitters. Improved device performances can be achieved by locking the high-quality phase and frequency of the master laser to a low-quality slave laser. In this research, a proper optical injection locking system will be developed and characterized by the perspective of improving certain parameters in optical communication systems. A simulation model will be developed and then the characterization will be done for the locking range, bandwidth, amplitude, and phase noise transfer function. The anticipated output will be helpful for several applications like developing optical synchronization in phase-sensitive amplifiers which is useful for improving the transparent length and the operating margins of the optical network system. Also, it will build up a pathway to increase the speed of the optical communication system by the increment of the bandwidth.

Index terms— Optical injection locking, locking range, bandwidth, intensity and phase noise.

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List of Abbreviations

Abbreviation	Description
OIL	Optical Injection Locking
RIN	Relative Intensity Noise
ASE	Amplified Spontaneous Emission Noise