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Investigations on Chirp Managed Laser

ABSTRACT - Masterthesis

Conventional Directly Modulated Lasers (DMLs) cannot be used for longer distances (typically less than 5 km at 10 Gb/s, 1.55 μm wavelength in a Standard Single Mode Fiber, SSMF) [24] compared to other transmitter sources using Externally Modulated Laser (EML) transmitter schemes owing to the undesirable, inherent time-dependent chirping characteristics in DMLs, which causes severe distortion of signals after certain distance.

The advent of Electro-Absorption Modulators (EAM) and Mach-Zehnder Modulators (MZM) have given more fame and applications to externally modulated laser transmitters than traditional directly modulated lasers since EMLs have proven to have far better chirp behavior [2,28]. However EMLs require dispersion compensation modules (DCMs) to achieve longer distances [7, 28]. Thus relegating the usage of DMLs to low speed (e.g. 2.5 Gb/s) uncompensated systems. However the incorporation of external modulators make EML transmitters large and with higher power requirements [3, 29].

Based an the aforementioned shortfalls, a new optical transmitter which seeks to address the size, power, dispersion tolerance and cost issues raised by EMLs has been developed recently. This new optical transmitter, Chirp Managed Lasers (CMLs), provide high optical output power, long transmission distances in Standard Single Mode Fibers [1, 3], and their reach is ~250 km at 1.55 μm in a 10 Gb/s uncompensated system [1].

This research work presents investigations on chirp managed laser which focuses an analysis and theoretical considerations on principles of operation regarding the various components, such as DFB laser source, optical spectrum re-shaper filter, photodiodes etc. It seeks to discuss profound investigations on the concept of chirp and how the wavelength of a chirp managed laser can be controlled. Experimental analysis on the output power, spectrum and temperature of the chirp managed laser are also considered. Finally, modulation experiment is carried out and typical applications of chirp managed lasers are also discussed.