

Dynamics of Mach Zehnder Modulator in Open and Closed Loop Bias Condition

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Abstract : Numerous efforts have been done in the past decade to develop the methods of secure communication that are free from interception and eavesdropping. In fiber optic communication, chaotic optical carrier signals are used for data encryption in secure data transmission. Mach-Zehnder Modulators (MZM) are the key components for generating the chaotic signals to be used as optical carriers. This paper presents the dynamics of a lithium niobate MZM modulator under various biasing conditions. The chaotic fluctuations of the intensity of a laser diode have been generated using the electro-optic MZM modulator operating in a highly nonlinear regime. The modulator is driven in closed loop by its own output at an earlier time. When used as an electro-optic oscillator employing delayed feedback, the MZM displays a wide range of output waveforms of varying complexity. The dynamical behavior of the system ranges from periodic to nonlinear oscillations. The nonlinearity displayed by the system is reproducible and is easily controllable. In this paper, we demonstrate a wide variety of optical signals generated by MZM using easily controllable device parameters in both open and close loop bias conditions.

Keywords : chaotic carrier, fiber optic communication, Mach-Zehnder modulator, secure data transmission

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