Title: Etude théorique et expérimentale de la dynamique des oscillateurs optoélectroniques

Abstract:

This thesis deals with the experimental and theoretical study of the optoelectronic oscillators. The first system is the classical optoelectronic oscillator. We study in this case the characteristics of the first Hopf bifurcation, after we characterize the evolution of the period of the oscillations depending on different tuning parameters of the system (power output of the laser and bias voltage) when the delay is not considered. The second oscillator is new. It is principally constituted by the laser diode and the self-sustained Van der Pol Oscillator. The non-linearity is assumed by the laser diode and the oscillation frequency is fixed by the Van der Pol Oscillator.

After the establishment of the mathematical model of the system, we have obtained several oscillation waveforms, such as: limit-cycles and relaxation oscillations. It follows the experimental part, in which the theoretical waveforms are verified. The last oscillator is the most simple optoelectronic oscillator, because it is principally based on the laser diode with a closed delay feedback loop. It presents a very rich dynamics with the apparition of two bifurcations, the emergence of limit-cycle oscillations with a fast time scale in the first bifurcation and slow timescale for the second bifurcation. The study shows the stability of the system and opens a large field for applications in many technological areas.

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