STUDY OF STATIONARY STATES AND DYNAMICS OF A LASER WITH FEEDBACK FROM EXTERNAL CAVITIES

Eugeniu GRIGORIEV

Technical University of Moldova, Faculty of Electronics and Telecommunications, Dept. of Physics, Chișinău, Rep of Moldova

eugen.grigoriev@fiz.utm.md

Abstract: *In this paper, we focus on the investigation of the dynamical properties of InGaN laser with quantum dots active medium. The feedback comes from T-structure external mirrors.*

Keywords: *Quantum dots lasers, optical feedback, communications, optical systems.*

During recent decade, the phenomena of self-organization in optical systems have received much attention due to its fundamental and application interests. From the application point of view, chaos-based communications have become an option to improve privacy and security in date transmission [1,2]. It is well known, that optical feedback can considerably influence the dynamical behavior of a quantum dot laser of InGaN integrated with an external optical feedback [3].

The investigated setup is shown in Fig. 1. The laser is under the influence of double external cavity. The mirrors R_1 and R_2 are located at distance l_1 and l_2 from the laser front facet, respectively. The phases φ and ψ can be changed separately by a piezo-elements (PE).

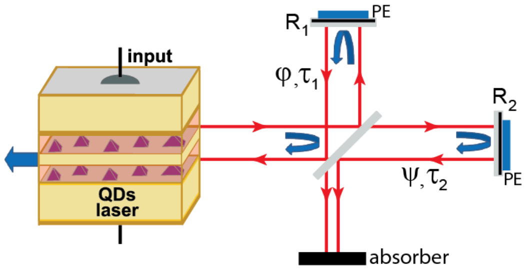

Figure 1. Setup of quantum dot laser under the influence of double feedback

The stationary states, so called external cavity modes, are analyzed in the framework of Bloch model [3]:

$$\begin{cases} \dfrac{dE}{d\tau} = -kE + 2Z^{QD}\Gamma gp + \dfrac{Z^{QD}\Gamma\beta}{\tau_{eff}E^*}\left(\dfrac{N+1}{2}\right)^2 + \Gamma_1 e^{-i\varphi}E(\tau-\tau_1) + \Gamma_2 e^{-i\psi}E(\tau-\tau_2), \\ \dfrac{dp}{d\tau} = -\gamma p + gNE, \\ \dfrac{dN}{d\tau} = -4gE^*p + \dfrac{d_0 - N}{T_1} - \dfrac{1}{\tau_{eff}}\left(\dfrac{N+1}{2}\right)^2. \end{cases} \quad (1)$$

It is our aim in this paper to investigate the possibility of developing new integrated, and compact sources capable of generating controlled light for its potential use in communication systems. The nature of bifurcations and the stability of steady state solutions are analyzed in terms of the dependence on magnitude and phase of the feedbacks.

References:

1. ARGYRIS, A., SYVRIDIS, D., LARGER L., et al. Chaos-based communications at high bit rates using commercial fibre optic links. In: *Nature*, 2005, 438, pp.343-346.
2. TRONCIU V. et al Chaos Generation and Synchronization Using an Integrated Source with an Air Gap, In: *IEE Journal of Quantum Electronics.* 2010, 46(12), pp. 46.
3. KRAUSKOPF, B., LENSTRA, D. Fundamental issues of nonlinear laser dynamics. In: *AIP Conf. Proc.*, 2000, pp. 548.