ROUTE TO CHAOS AND NONRADIATIVE RECOMBINATION IN LASER DIODE

SALAH ABDULRHMANN

Department of Physics, Faculty of Science, Assiut University, Assiut, Egypt

Department of Physics, Faculty of Science, Jazan University, Jazan, KSA

ABSTRACT

This paper investigates influence of nonradiative recombination lifetime on the route to chaos of semiconductor laser and associated operation states over a wide range of injection current. The study is based on numerical solutions of an improved time delay model of semiconductor laser subject to optical feedback. The simulation results show that nonradiative recombination lifetime causes significant changes in the route to chaos and the laser dynamic. The feedback strength when the laser transits from continues wave to periodic oscillation or period doubling or chaos state decreases with the increase in the nonradiative recombination lifetime. We identify the route to chaos states of SLs in three distinct operating regions, namely, periodic oscillation, sub-harmonic, and period doubling, which are depending on the value of the nonradiative recombination lifetime and injection current ratio. At higher levels of the injection current, lowest nonradiative recombination lifetime value stabilizes the laser operation and stimulating the laser to operate in periodic oscillation or continues wave.

KEYWORDS: Semiconductor Laser, Nonradiative Recombination, Optical Feedback, Periodic Oscillation, Periode Doupling