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ROUTE-TO-CHAOS AND OPERATION OF LASER DIODE UNDER OPTICAL FEEDBACK WITH LINEWIDTH ENHANCEMENT FACTOR

SALAH ABDULRHMANN[1] & A. AL-HOSSAIN[2]

[1]Department of Physics, Faculty of Science, Assiut University, Assiut, Egypt

[1]Department of Physics, Faculty of Science, Jazan University, KSA,

[2]Department of Mathematics, Faculty of Science, Jazan University, KSA

ABSTRACT

This paper investigates numerically influence of linewidth enhancement factor and injection current on the type of the route-to-chaos and associated operation states of laser diodes under external optical feedback. The study is based on numerical solutions of a time-delay model of rate equations, and the solutions are employed to construct bifurcation diagrams and to examine the output time fluctuations and phase portraits of the laser. The simulation results show that linewidth enhancement factor causes significant changes in the route-to-chaos and the laser states. The state of the laser is identified into six distinct regimes, namely, continuous wave, periodic oscillation, period doubling or two, period-three, period-four oscillations and chaos, which is depending on the value of the linewidth enhancement factor, feedback strength and injection current level. The route-to-chaos is period-four when linewidth enhancement factor is less than or equal to three. The route is period-three when linewidth enhancement factor increases up to 7. The feedback strength when the laser transits from continuous wave to periodic oscillation, period doubling or chaos state decreases with the increase in the linewidth enhancement factor. Decreasing the injection current and increasing the linewidth enhancement factor stimulating the laser to operate in continuous and periodic oscillations.

KEYWORDS: ***Laser Diodes, Linewidth Enhancement Factor, Optical Feedback, and Chaos***

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