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Dynamical effects of optical feedback on InAs/ InGaAs Quantum dot semiconductor laser

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Abstract:

Quantum dot semiconductor InAs/ InGaAs laser subject to optical feedback is examined The effect of control parameters viz. feedback strength , linewidth enhancement factor ,delay time and optical confinement factor are studied . Rich dynamics are observed ranging from steady state output ,oscillatory one in the shape of period one and period two to chaotic one

Keywords : Quantum dot laser, Optical feedback ,Periodic and chaotic output.

1.Introduction:

Since the early days of lasers ,the problem of feedback appeared to be inevitable facing the people working in the field of laser interaction with matter for example the experiments concerning frequency generation or injection locking [1].Part of the incident light is back reflected to laser cavity causing problems like instabilities in power level and frequency and at the same times leads to disappearance of the laser output ,a phenomena nowadays called death by delay[2].

Since the pioneer work of Lang and Kobayashi the problem of feedback in semiconductor lasers (SCLs)where it has been discussed and investigated thoroughly from the experimental part and theoretical one [3], enormous attention has been paid toward the study of feedback and many techniques have been explored and studied for different reasons . Kitching etal [4] have used weak ,dispersive optical feedback ,which led to the amplitude noise reduction in SCL ,Yousefi etal [5] have used filtered optical feedback to control the nonlinear dynamics of a SCL ,Lin and Liu [6] have used an optoelectronic feedback system applied to an optically injected SCL ,Zhong etal [7] have used phase –conjugated feedback in synchronization and communication based SCLs, Blin etal [8] have used a distributed feedback to study a spectral and time phenomena in optical injection SCL ,Guignard etal [9] have used a nonlinear optical feedback to study the phenomena harmonic in passive mode locked single-frequency SCL ,Li et al [10] has used a negative optoelectronic feedback system to control the nonlinear dynamics in external –cavity VCSELs ,etc . The study of