Name : Prof. Dr. Moustafa Farghal Ahmed

Dept. : Physics

Title : Inducing Single-Mode Oscillation in Fabry-Perot InGaAsP Lasers by Applying External Optical Feedback

Moustafa F. Ahmed and M. Yamada

Journal : IET Optoelectronics, 4(3), 133-141 (2010)**.** **Impact Factor:** 1.1

Abstract:

We report on inducing single-mode oscillation in InGaAsP multimode lasers with Fabry-Perot (FP) structures by applying external optical feedback (OFB). The study is based on numerical solution of a time-delay multimode rate equation model taking into account both symmetric gain suppression (SGS) and asymmetric gain suppression (AGS) of modal gain. The mode dynamics and modal operation are characterized over a wide range of OFB in terms of time trajectories of the most dominant modes and the corresponding time-average output spectrum. The obtained results show that strong OFB reduces AGS relative to the linear gain in the vicinity of the dominant modes. This effect moderates the contribution of AGS to the longitudinal mode competition (LMC) in such a way to induce oscillation into oscillation in single mode with the laser operating in continuous wave (CW). In this region of strong OFB, the side-mode suppression ratio (SMSR) increases with strengthening OFB. Increasing the external cavity length was found to decrease the OFB range of single mode oscillation and enhance chaotic dynamics of the laser.

Keywords:

Semiconductor laser, optical feedback, gain suppression, mode competition

Name : Prof. Dr. Moustafa Farghal Ahmed

Dept. : Physics

Title : Numerical modeling of the output and operations of semiconductor lasers subject to strong optical feedback and is dependence on the linewidth-enhancement factor

S. Abdulrhmann, M. Yamada and **Moustafa Ahmed**

Journal : International Journal of Numerical Modeling and Simulation: Electronic Networks, Devices and Fields, 24(3), 218-229 (2011)**.**

Impact Factor: 0.4

Abstract:

Influence of the linewidth-enhancement factor on the output and operations of InGaAs/InP pumping lasers emitting at a wavelength of 980 nm under strong optical feedback is investigated numerically. The investigations are performed based on intensive numerical integration of an improved time-delay rate equations of semiconductor lasers over wide ranges of the linewidth-enhancement factor and optical feedback strength. The results show that the semiconductor laser operates under strong optical feedback in continuous wave and pulsation at small values of the linewidth-enhancement factor. Under large values of the linewidth-enhancement factor, the laser happens to exhibit chaos and pulsation. We predict that semiconductor laser subjected to strong optical feedback exhibits much more stable pulsing operation under higher values of the linewidth-enhancement factor, which indicates that the laser is locked at the external cavity frequency.

Keywords:

Semiconductor laser, optical feedback, linewidth enhancement factor, dynamics, simulation

Name : Prof. Dr. Moustafa Farghal Ahmed

Dept. : Physics

Title : Characterization of Analog Modulation of AlGaAs Lasers and the Induced Intensity Noise

Moustafa Ahmed, N. Z. El-sayed, H. Ibrahim and K. Abdelhady

Journal : Turkish Journal of Physics, 36, 39-50, 2012. **Impact Factor:** (NA)

Abstract:

The dynamics of AlGaAs laser diodes under analog intensity modulation are characterized and the associated intensity noise is evaluated. The study is based on numerical solution of the stochastic rate equations of semiconductor lasers. Based on the shape of the modulated laser signal, the modulation dynamics are classified into eight distinct types. Four types are characterized by continuous periodic signals, and other three types have periodic pulsing signals. These signals happen to have period doubling or superposed by sub-peaks from the relaxation oscillations of the laser. The last type is chaos, in which the signal is irregular and non-uniform. The noise results show that the relative intensity noise is most close to the quantum level under weak modulation where the laser signal is sinusoidal. LF-RIN and is pronounced when the laser emits irregular spike-like pulses under low-frequency strong modulation. The chaotic dynamics dominate the region of strong with modulation frequencies around the relaxation frequency of the laser.

Keywords:

Semiconductor laser, analog modulation, noise, optical disc, simulation