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Mode-competition noise associated with microwave modulation of multimode semiconductor lasers

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Abstract

We analyze the mode-competition (MC) phenomenon and the associated noise in multimode semiconductor lasers at microwave modulation. The study is based on the multimode rate-equation model, which takes into account the mechanisms of modal gain suppression. The MC is evaluated by the correlation coefficients between oscillating modes in the laser cavity. We show that an increase in the modulation depth changes the mode coupling from anticorrelation to positive correlation and then to complete coupling, which corresponds to emission of periodic pulses. The frequency spectra of relative intensity noise (RIN) exhibit sharp peaks at the modulation frequency and higher harmonics. The increase in the modulation depth is associated with suppression of the total and modal RIN under high-frequency modulation and with noise enhancement under low-frequency modulation.

Keywords

KeyWords Plus: ASYMMETRIC GAIN SATURATION; INJECTION-LASERS; SINUSOIDAL MODULATION; INTENSITY MODULATION; OPTICAL FEEDBACK; FLUCTUATIONS; PARTITION; ACCOUNT; DIODES

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