Abstracts

Noise in an AlGaAs Semiconductor Laser Amplifier

The noise characteristics in a Fabry-Perot (FP) cavity type semiconductor laser amplifier, biased at just below its oscillation thresh-old current, have been studied theoretically and experimentally. Quantum mechanical multimode rate equations containing a Langevin shot noise source and an input signal term were numerically solved for an exponential band-tail model with no k-selection rule. Noise power calculated using this rate equation was compared with a simpler photon statistic master equation method. The experimental results on noise power for an AlGaAs laser amplifier are in reasonable agreement with the two different theoretical predictions. Dominant noise powers in a semiconductor laser amplifier are beat noise powers between signal and spontaneous emission, and between spontaneous emission components. Noise characteristics in a Fabry-Perot cavity type laser amplifier can be improved both by the reduction of the facet mirror reflectivities and by use of an asymmetric cavity configuration with low-input and high-output mirror reflectivities. Two beat noise powers are expressed in simple analytic form by introducing an equivalent noise bandwidth and an excess noise coefficient as figures of merit in an optical amplifier.

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