Abstracts

Self-consistent analysis of carrier-transport and carrier-capture dynamics in quantum cascade intersubband semiconductor lasers

K. Kalna, C.Y.L. Cheung, I. Pierce and K.A. Shore. "Self-consistent analysis of carrier-transport and carrier-capture dynamics in quantum cascade intersubband semiconductor lasers." 2000 Transactions on Microwave Theory and Techniques 48.4 (Apr. 2000, Part II [T-MTT] (Special Issue on Terahertz Electronics)): 639-644.

A methodology for the self-consistent analysis of carrier transport and carrier capture aspects of the dynamics of quantum cascade intersubband semiconductor lasers is described in this paper. The approach is used to analyze two prototype quantum cascade lasers. The self-consistent analysis incorporates the calculation of the electron densities and temperatures in each subband, together with the intersubband relaxation time. In the calculation of the relaxation time, we take into account the electron interaction with polar optical and acoustic phonons, as well as electron degeneracy. In addition, we also calculate the capture time, considering backward processes that play a role in the electron transition from an injection into an active region. The calculations indicate intersubband relaxation times of order 1 ps and capture times of order 100 fs.

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