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Optimization and Rate-Equation Model for Second-Harmonic Generation in Mid-Infrared Quantum Cascade Lasers JING BAI, DAVID CITRIN, Georgia Institute of Technology — We present the rate-equation simulation of a mid-infrared quantum cascade laser with optimized second-harmonic generation. The simulation is performed by optimization of the structure design followed by self-consistently solving the rate equations for the carriers in the various levels. The optimized structure was obtained by supersymmetric quantum mechanics with both position-depended mass and band nonparabolicity included. In the rate-equation model, the second harmonic generation process is described by sequentially two single photon absorption and one second-harmonic photon generation. Nonunity pumping efficiency is accounted by all relevant electron-electron and electron-LO phonon scatterings between injector/collector and active region are included. The modal gain, linear power and second-harmonic power can then be calculated based on the steady-state populations in the active region. Results show that the optimized structure has higher modal gain and linear to nonlinear conversion efficiency.

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