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Optimizing planar waveguide design for multi-wavelength and nonlinear quantum cascade lasers SCOTT HOWARD, FATIMA TOOR, ANTHONY HOFFMAN, CLAIRE GMACHL, Princeton University, DEBORAH SIVCO, Lucent Technologies — High performance and novel multi-wavelength quantum cascade (QC) lasers present unique challenges in designing waveguides. We present a computational approach that uses the projected threshold current densities and mode overlaps to iteratively optimize the waveguide design. This program has been used to solve three specific problems by designing: (1) two dual wavelength QC laser structures (a 7.5 and 13.5 μm, and a 9.5 and 11.5 μm structure) with the goal of minimizing the threshold current of each pair of lasers simultaneously below the continuous wave threshold while maintaining an operating voltage less than 10 V; (2) a waveguide for high performance QC lasers with the goal of minimizing input electrical power at high operating temperatures; and (3) waveguides for nonlinear QC lasers designed for difference frequency generation with the goal of minimizing the threshold currents of the two integrated pump lasers, maximizing the overlap of the pump light with the monolithically-integrated nonlinear mixing region, and reducing the loss of the non-linear guided mode.

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