P-QEO6: Simulation of guided-wave optoelectronic devices employing wavelength-scale elements

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In the simulation of modern optoelectronic devices such as compact single-mode semiconductor lasers, wavelength-scale elements play an important role. In distributed-feedback (DFB) lasers wavelength-scale (quasi-)periodic gratings control the spectral properties of the emitted coherent radiation. Very commonly used simple models often fail in a sufficiently accurate description of realistic devices. Therefore, to allow for efficient device optimization, accurate models of grating structures are needed. We present a rigorous, numerically robust and - concerning device geometry and emission wavelength - very versatile model which also allows the accurate description of strongly coupled structures employing metal gratings and/or higher-order gratings for surface-emitting devices.

Furthermore, models based on a rigorous solution of Maxwell’s equations are presented for devices employing photonic crystal structures such as deeply etched slab waveguides. A special emphasis is laid on the modelling of out-of-plane scattering losses that may severely limit device performance. With the help of the model, waveguiding mechanisms in such discontinuous structures can be explained. In addition, far-fields of surface emitting structures can be calculated. Other applications such as waveguide junctions and the facet-reflectivity problem are also covered by the presented model.

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