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Numerical Analysis of Multilayer Waveguides Using Effective Refractive Index Method

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Abstract: With the help of the effective refractive index method we have numerically analyzed a multilayer planar waveguide structure and calculated the propagation constants, confinement factors, and transverse electric (TE) modes. A five-layer waveguide model has been provided to analyze the electro-magnetic wave propagation process. The analysis method has been applied to the 980 nm laser with active layer of GaInAs/GaInAsP strained quantum wells, GaInAsP confinement layers and GaInP cap layers. By changing the thickness of confinement layers, we obtained confinement factor as high as 95% with higher TE modes TE1 and TE2. The results are in good agreement with the experiment by A. Al-Muhanna et al. and give the new idea to enhance output power of semiconductor lasers. The analysis method can also be extended to any other slab multilayer waveguide structures, and the results are useful to the fabrication of optic-electronic devices.

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