

Jordan University of Science and Technology

Novel closed-form solution for spin-polarization in quantum dot VCSEL

Authors: Omar Qasaimeh

Abstract: A novel analytical model for spin-polarization in quantum dot VCSEL has been derived. The derived model includes the effect of spin relaxation of electron and hole in all discrete energy states. The model also takes into account the gain dispersion of the quantum dots, the birefringence, the linewidth enhancement factor and the doping concentration in the active layer. We find that spin relaxation of electrons has a stronger effect on the polarization characteristics of quantum dot VCSEL than spin relaxation of holes (especially in p-type doped spin injected quantum dot VCSEL). The derived model is accurate and exhibits negligible computational time compared with numerical models. In addition, the derived model is suitable for device design and optimization.