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| **Title:** | Improvement of Modulation Performance and Bandwidth of a 980 nm Strained In0.2Ga0.8As/GaAs QW VCSEL | | | |
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| **Published Journal Name:** | Journal of Optics | | | |
| **Type of Publication:** | Journal | | | |
| **Volume:** | 40 | | Issue | 1 |
| **Publisher:** | Springer | | | |
| **Publication Date:** | December 2010 (online),March 2011 (issue) | | | |
| **ISSN:** | | 0974-6900, 0972-8821 (print) | | |
| **DOI:** |  | | | |
| **URL:** | https://doi.org/10.1007/s12596-010-0027-4 | | | |
| **Other Related Info.:** | Pages 8-17 | | | |
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| **Abstract:** |  |
| In this work, the effect of differential gain of a strained In0.2Ga0.8As/GaAs QW VCSEL on its resonance frequency has been studied with the aim of improving the high speed performance of a 980 nm VCSEL. Computations using the analytical expression of modulation response show that the resonance frequency of a VCSEL increases with the increase of differential gain. The differential gain of a VCSEL has been varied from 5.1 × 10-16 cm2–11 × 10-16 cm2. It has been observed that a differential gain value of 10 × 10-16 cm2 contributes to a maximum resonance frequency of 5.65 GHz at 3 mA injection current and an active radius of 5.65 μm. For this combination of parameter values a maximum bandwidth of 8.75 GHz of a VCSEL has been achieved. Computations show that the maximum value of differential gain needs to be kept within 10 × 10-16 cm2; otherwise the performance of the laser degrades due to large reduction of carrier density as well as the amplification gain. The resonance frequency of a VCSEL has further been increased upto 9.69 GHz by increasing the injection current from 3 mA to 7.4 mA and reducing the noise amplitude. The corresponding bandwidth has been obtained as 15 GHz. The maximum computed value of *D*-factor is 3.76 GHz/√mA and the value of *K*-factor is computed as 0.17 ns which indicate good performance. | |