Abstracts

Direct Frequency Modulation in AlGaAs Semiconductor Lasers

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Direct frequency modulation characteristics in three different AlGaAs lasers - a channeled-substrate planar (CSP) laser, a buried-heterostructure (BH) laser, and a transverse-junction-stripe (TJS) laser- are studied theoretically and experimentally. Experimental FM responses are measured by using the Fabry-Perot interferometer and birefringent optical filters in the 0-5.2 GHz modulation frequency region. Experimental FM response dependence on modulation frequency, dc bias level, and stripe structure are successfully explained by the theoretical analyses considering both the carrier density modulation effect and the temperature change effect. FM response in the low modulation frequency region from 0 to 10 MHz, gradually decreasing with the modulation frequency, stems from the thermal effect. FM response in the high modulation frequency region from 10 MHz to 5.2 GHz is caused by the carrier effect. A flat FM response of several hundred MHz per 1 mA is observed in the CSP and TJS lasers, but a V-shaped FM response is obtained in the BH laser. Resonance peak due to relaxation oscillation and cutoff characteristics are observed in several gigahertz regions. Weak lateral mode confinement, strong vertical mode confinement, carrier injection outside the effective core region, and p-side down mounts are effective ways to achieve a flat and efficient FM response with a small spurious intensity modulation.

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