VCSELs with a high-index-contrast grating for mode-division multiplexing

A novel vertical-cavity surface-emitting laser (VCSEL) structure for space division multiplexing (SDM) is proposed and numerically investigated. This laser structure employs a high-index-contrast grating (HCG) as a light-emitting mirror. The reflectivity of the HCG mirror is spatially modulated to excite a specific transverse mode, while its transmission phase is kept spatially constant. This laser can provide the selective excitation of a specific transverse mode, leading to a high coupling efficiency to a few mode fiber. Compared to the phase plate approach in current SDM systems, the HCG-integrated VCSEL approach can be a much more compact and cheaper alternative.