High-Speed Optical Beam-Steering Based on Phase-Arrayed Waveguides

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Optical beam steering devices are especially important because of their wide range of applications in optical scanners, laser printers, optical memory, optical interconnects, optical switches, and data conversion systems. A variety of methods have been reported to achieve optical beam steering by means of electromechanical and electrooptical effects. Although mechanical beam-steering methods [1] provide efficient large deflection angles, they are usually slow, power hungry, and bulky. Electrooptical beam steering provides a motionless way to deflect the optical beam, thus having the advantages of fast response times, small sizes, and long lifetimes. The majority of electrooptical beam-steering devices that have been demonstrated employ phase-arrayed waveguides [2], or electrically tunable diffraction gratings [3].

Here, we present an optical beam-steering system based on phase-arrayed waveguides. Highly efficient beam steering at large angular resolution can be achieved through this deflection system. We report a two-waveguide beam-steering prototype based on GaAs/AlGaAs multiple quantum wells and demonstrate a 100 mRad deflection angle and two resolvable deflection spots, consuming an electrical power of 4mW. High-speed beam steering is achieved through wideband phase modulation characteristics of the employed traveling wave phase modulator based on quantum-confined Stark effect. An instrument limited beam steering speed of 18GHz, projected to an estimated beam steering speed of more than 50 GHz, was measured. To our knowledge, this is the fastest optical beam deflection ever reported.

References

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