DESIGN AND FABRICATION OF A TUNABLE SEMICONDUCTOR LASER FOR NARROW LINEWIDTH APPLICATIONS

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ABSTRACT

Most of the existing diode lasers are mainly Fabry-Perot (FP) and distributed feedback (DFB) diode lasers. These, however, suffer several limitations concerning their spectral properties: they are often multimode, have large line width, suffer from mode hops and their wavelength tuning is achieved by varying their temperature. These limitations may be serious in many potential applications such as optical communication, high resolution spectroscopy and all applications which require a narrow line width and precise tunability. It is for these reasons that it became necessary to developed a tunable external cavity diode laser (ECDL) for optical experiments requiring a light source that has got a narrow line width, no mode hop and can be tuned over some wavelength range.

An ECDL is a laser system whose resonator is made up of optical elements external to the diode laser itself. The external cavity is composed of the diode laser, a diffraction grating and a high quality optical flat mirror. One facet of the diode laser acts as the end mirror for the external cavity. The second facet is antireflection (AR) coated so as to increase the loss due to the internal cavity, thereby raising the threshold level required for lasing to commence. As a consequence the internal cavity is inhibited from lasing.

The diffraction grating and a high quality end mirror are used to provide an optical feed back to the diode laser. The grating splits any incident beam from the diode into diffraction orders. The alignment of the mirror and the grating is such that, the zeroth order is coupled to the end mirror which reflects it back to the grating; the grating reflects back the first order to the laser thereby establishing an external cavity. Different wavelengths of laser beam can be emitted by varying the mirror angle.