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Frequency tunability and temporal characteristics of a DAMC distributed feedback dye laser

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Abstract. The frequency tunablity characteristics of a simple prism configuration distributed feedback dye laser (DFDL) pumped by a low pressure nitrogen gas laser are described. Tunability is studied as a function of the refractive index of the dye solution and also as a function of the angle of the interfering beams of the pump laser. The tunability range for the dye studied is from 440 to 480 nm with a spectral width of 0·1 Å and the time duration of the DFDL pulses was 50 ps.

Keywords. Frequency tunablity; distributed feedback dye laser; Bragg scattering.

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1. Introduction

Dye lasers with distributed feedback are simple and elegant sources of narrow band, frequency tunable, coherent radiation without any complex frequency selective elements. In addition these distributed feedback dye lasers (DFDL) are convenient techniques for generating coherent radiation of picosecond duration over the entire visible region. They are therefore useful for several spectroscopic and fast kinetic studies. Here we describe the tunablity characteristics of a prism configuration DFDL system tunable throughout the gain bandwidth of the dye 7 diethyl amino 4 methyl coumarin (7DAMC) lasing medium and capable of giving pulses of 50 ps duration. A further advantage is that both the DFDL and the pumping nitrogen laser can be easily built in laboratories with modest financial resources and workshop facilities since the DFDL system does not contain any sophisticated optical elements.

The operation of a distributed feedback structure was demonstrated by Kogelink and Shank (1971). If the active medium is incorporated into a spatially periodic structure and excited, the counter running waves travelling in the periodic structure receive light along their path by Bragg scattering. This creates a feedback mechanism distributed throughout the length of the active medium. If the feedback is sufficient, oscillation occurs. The spectral selection occurs due to the wavelength selectivity of the Bragg scattering (Kogelink and Shank 1972). In this paper we describe a simple prism-based optical arrangement which makes it possible to obtain narrow linewidth frequency tunable operation of a DFDL.