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Technical note



Tunable Bandpass filters with wide deep out-of-band blocking

Introduction

Tunable bandpass filters have many applications in photonic instruments. Some common examples are exciter and emission filters of spectrofluorometers and tunable light sources.

Traditionally, tunable filters are constructed based on a rotating diffraction grating or prism using a precise angular meter to tune the desired wavelength and a variable slit to select the bandwidth. However, such systems are very sensitive to environmental conditions like temperature and vibration as well as wear in the motor parts.

Recently, a new kind of tunable bandpass filter has been introduced that utilize a set of Continuously Variable Interference Filters (CVIFs) – also known as Linear Variable Filters. This construction is simpler and more stable than the rotating grating type since it only requires linear translations along one axis.

For many applications, it is desirable to cover the full wavelength range of silicon-based detectors (350 – 1100 nm). Constructing CVIFs with high out-of-band blocking for such a wide wavelength range is a challenge. However, in this technical note we will describe how tunable bandpass filters with wide and deep out-of-band blocking can be built using CVIFs combined with homogeneous blocking filters.

Continuously Variable Filters

A Continuously Variable Filter is an optical component where the filter edge varies continuously along one physical dimension of the filter as illustrated on Figure 1 for a Continuously Variable Long Wave Pass edge filter (CVLWP). At position 1 the filter edge is in the blue wavelength region and basically the entire spectrum is transmitted through the filter. At position 2, the edge is in the green wavelength range and thereby wavelengths longer than the green are transmitted only. Finally, at position 3, the edge is in the red wavelength region letting only the red wavelengths of the spectrum through.

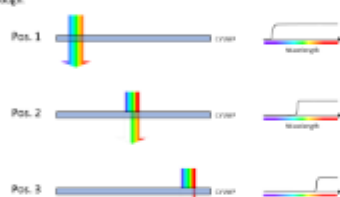


Figure 1: Illustration of a Continuously Variable Long Wave Pass edge filter. The filter wavelength edge depends on the position on the filter.

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Tunable Bandpass Filters with Wide Deep Out-of-Band Blocking

This technical white paper describes how tunable bandpass filters with wide and deep out-of-band blocking can be built using continuously variable edge filters combined with homogeneous blocking filters.

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