# Add Drop Multiplexer For DWDM On CWDM Systems

**File name:** `DWDM on CWDM.apc`

This is a rather complex circuit that realize an Add-Drop filter for a single channel of a DWDM on CWDM system. Groups of eight closely spaced channels (50 GHz) are spaced 20 nm apart. The circuit is able to separate and insert a single channel in the octect, first separating the group and then working on the single channels. The upper part realizes an original way to make a band selector (400 GHz) and the lower part is a selective filter able to add and drop a single channel in the selected octet. Straight and bent waveguides, Bragg gratings, directional couplers, three way directional couplers, waveguide crossing and ring resonators are used as building blocks. This example shows how much is important to consider the whole circuit and not only the single building blocks. The transfer functions of the two filters are reported in fig. 2a and 2b.These can be obtained by isolating the desired portion of the circuit (just cut and paste somewhere) and simulating with suitable sources. More easily, junctions with a very high insertion loss can be easily inserted in the circuit to isolate the desired portion.

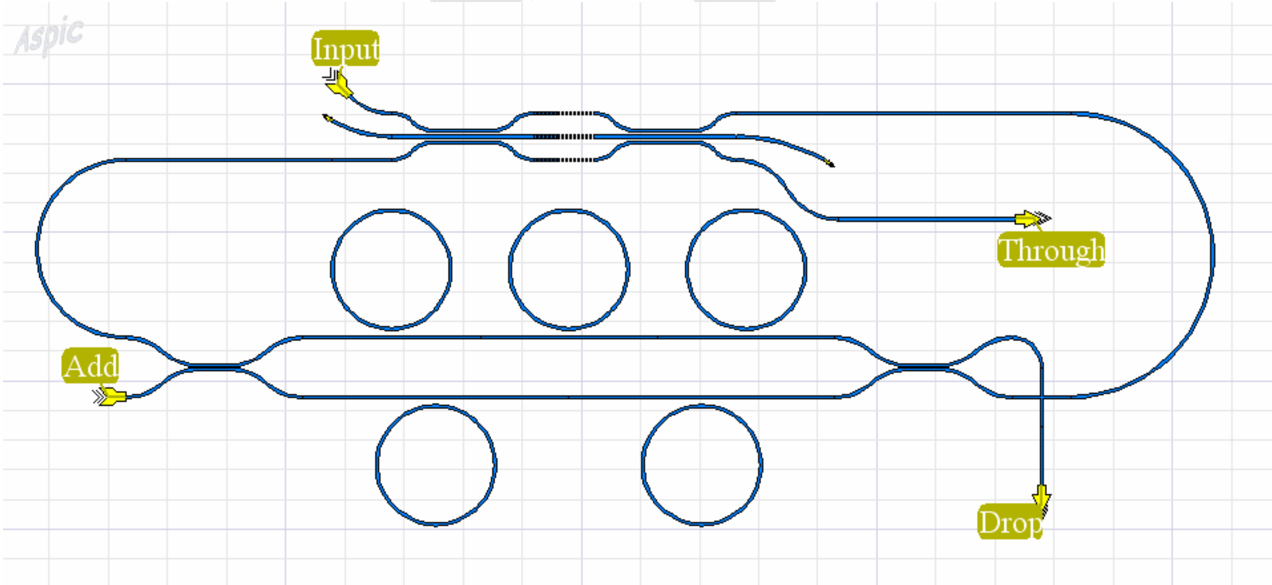


*Fig. 1 – DWDM on CWDM filter*

Fig. 2a shows the transmission and reflection characteristic of the three arm Mach-Zehnder loaded with Bragg gratings with a bandwidth equal to 1 THz. Gaussian apodized Bragg grating have been used in order to have a strong out of band rejection. The 'Discretization' parameter has been set to 25, that is the grating has been divided in 25 small sections considered uniform. Fig. 2b shows the bar and cross characteristic of the lower filter. The characteristic is periodical with a FSR=400 GHz and the bandwidth is 40 GHz. The waveguide crossing has been assumed ideal, with no losses and no crosstalk.

Fig. 3 shows the transfer function at the drop port of the whole device with apodized gratings (blue), at the drop with uniform grating (green) and at the through port (red). It is interesting to see how the single transfer functions are modified, especially the out-of-band behavior that is strongly affected by the resonance of the external loop. In case uniform gratings are used, the rejection is very poor also far away from the grating reflection band. The oscillations are due to the resonances of the outer big loop.

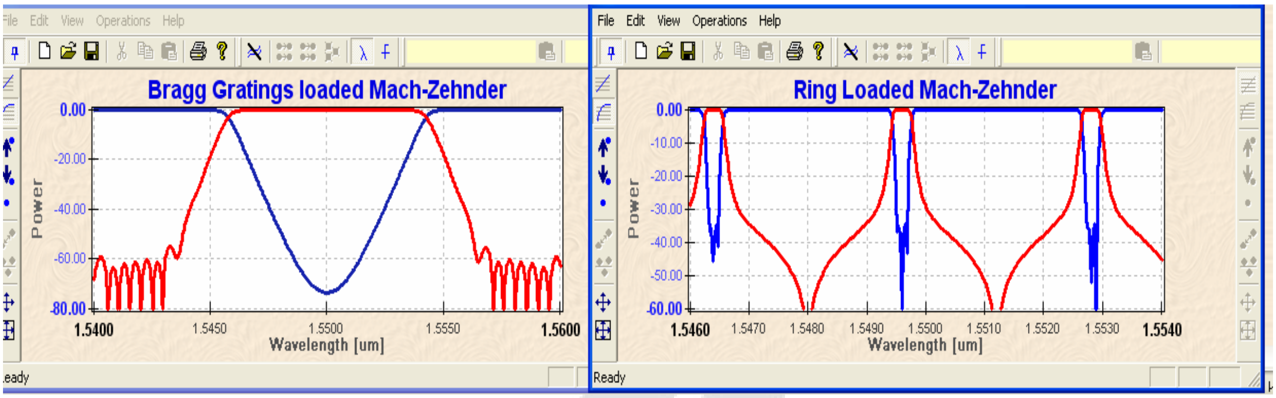


*Fig. 2 – a) Transfer function of the band selector (three arm Mach-Zehnder with Bragg gratings) and b) transfer function of the balanced Mach- Zehnder loaded with five rings.*

Uniform grating do not need the ‘discretization’ parameter and their length is one third of the apodized ones in order to have the same reflection.
Further, the intensity inside the loop oscillates because of spurious resonances and it is enhanced even by 12 dB! Aspic is very useful to investigate such cases, difficult to predict analytically and even intuitively.

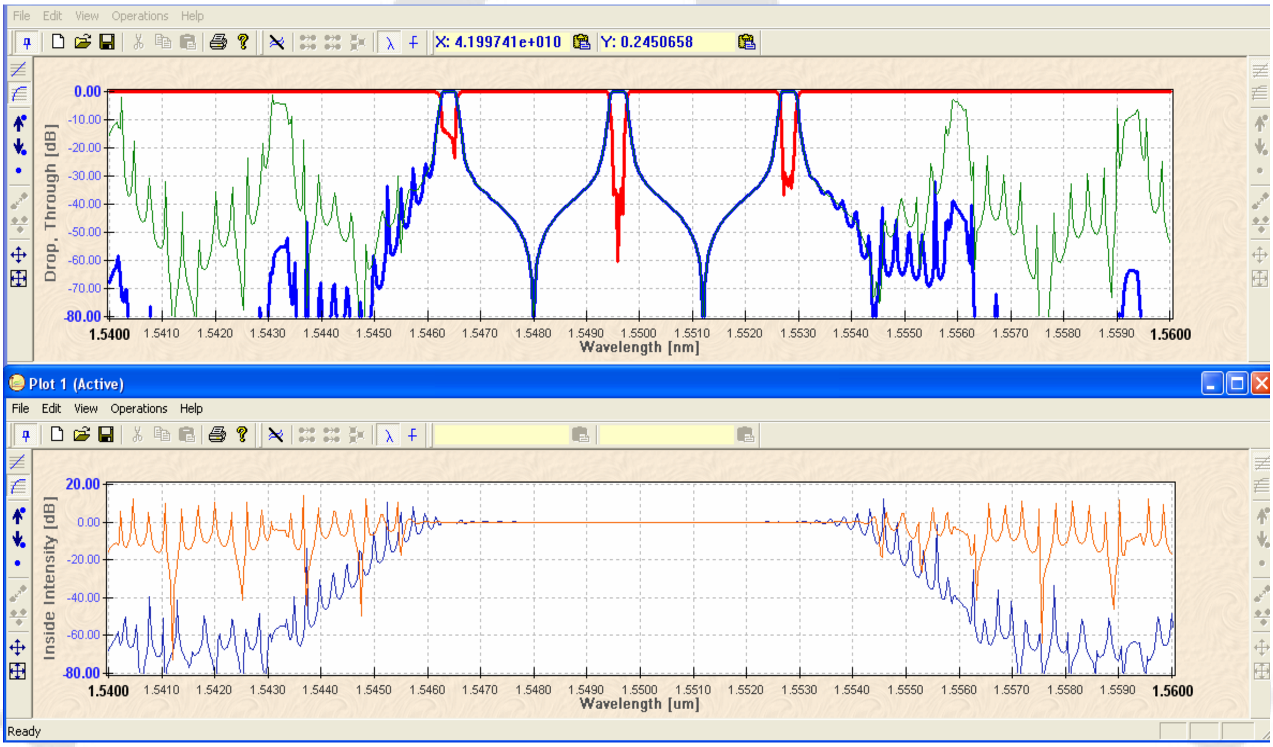


*Fig. 3 – a) Drop and Through transfer function with uniform and apodized gratings. b) Intensity of the recirculating signal inside the circuit.*