EPIPPROP *for AWGs and Echelle gratings*

EPIPPROP is a unique and innovative tool for **WDM/DWDM applications**, combining the only commercial 3D **echelle grating** model with a super-efficient approach to modelling **AWGs**.

EPIPPROP combines Photon Design's proven expertise in mode solving with an efficient semi-analytical method to solve light propagation in wide slab waveguide regions. The result is **an accurate 3D fully vectorial solution** that can model large devices, even mm's in size, in minutes.

Interested in Echelle gratings and AWGs? Why not try both in one package and find the best solution for your diffractive device!

- ☑ **3D fully vectorial modelling of echelle gratings and AWGs**
- ☑ **Ultra fast propagation** in the free-space region using innovative algorithms
- ☑ Built-in waveguide **mode solver**: fully vectorial 2D+z finite-difference solver
- ☑ I/O waveguide arrays support **multi-mode waveguides** & arbitrary polarisation
- ☑ Model surface roughness variations in the thickness of the slab
- ☑ Use a **material database** to capture the effect of material **dispersion**
- ☑ Simulate **tapering** and **cross-coupling** between adjacent waveguides
- ☑ Simulate **channel broadening** with MMI input and output, including tapers
- ☑ Space output waveguide channels by wavelength and frequency
- ☑ Export any design layout to a multilayer **GDS-II** file: from CAD to Fab in one click!

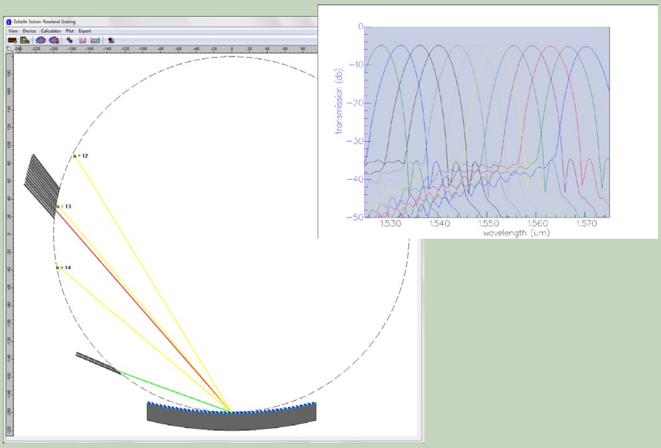
AWG

- ☑ Two parameterised templates with AWG waveguides with varying radius single bend or fixed radius double bend
- ☑ Choose wavelength, diffraction order, waveguide geometry, mode of operation and number of waveguides, then let EPIPPROP automatically design the layout
- ☑ Model the effect of material loss and scattering loss in the array of waveguides

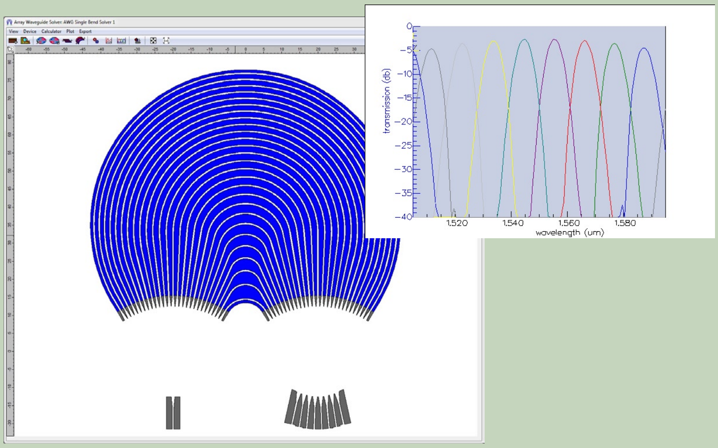
Echelle

- ☑ Use **tunable grating templates** for Rowland circle, bifocal point stigmatic and our unique Perfect Chirped Grating, or **import your own** echelle design
- ☑ 4 different **facet geometries**: flat facets, curved facets, corner mirrors & DBRs
- ☑ Supports **any grating surface**, e.g. **metal and non-vertically etched facets**
- ☑ Model fab tolerances by modelling corner rounding of the facets on any grating
- ☑ Simulate multiple vertical slab modes and the coupling between them
- ☑ Import response curves to model any arbitrary reflectivity from the grating

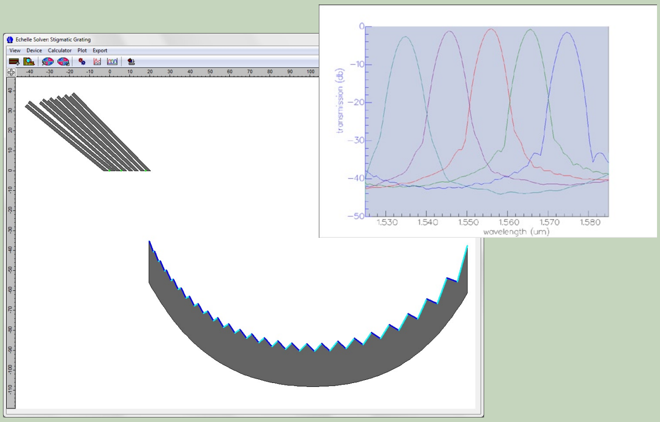
☑ Echelle grating and AWG templates



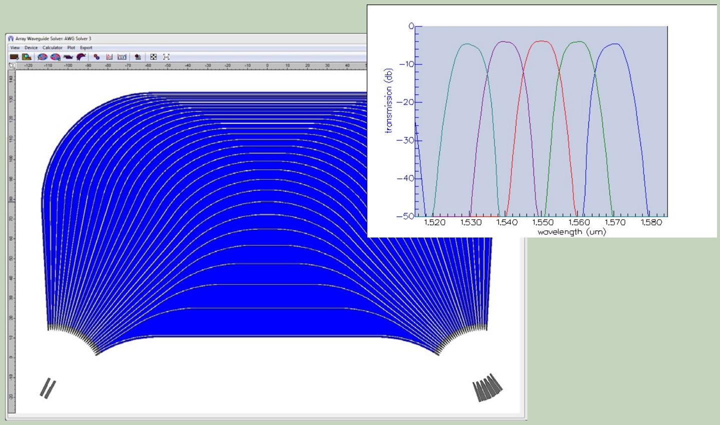
Echelle: Rowland design



AWG: varying radius single bend



Echelle: stigmatic design



AWG: fixed radius double bend with MMIs

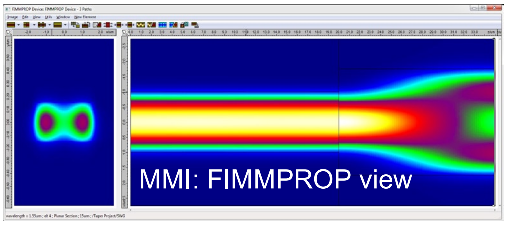
EPIPPROP

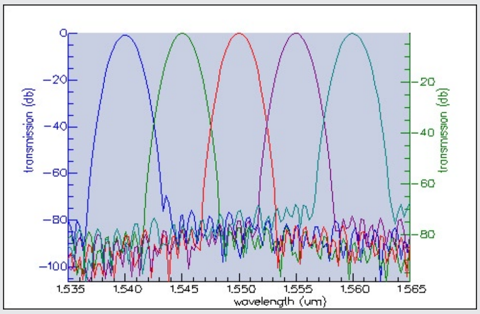
☑ MMI channel broadening (with FIMMPROP link)

Channel broadening allows you to increase the wavelength tolerance of your structure, allowing you to get around shifts in channel position resulting from imperfections in the slab waveguide, material properties, doping, temperature variation or multiple other causes.

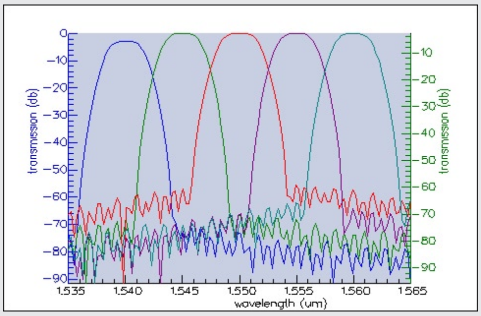
One approach to introduce channel broadening whilst avoiding multi-mode behaviour at the I/O waveguides is to use multi-section MMI input waveguides. This can be modelled using EPIPPROP with FIMMPROP.

You can see here the effect of channel broadening on the spectrum of an echelle grating modelled with these tools. The 1dB-cutoff-width of the peak has more than doubled from 1.2nm to 2.5nm. This comes at the cost of an extra 2dB insertion loss.





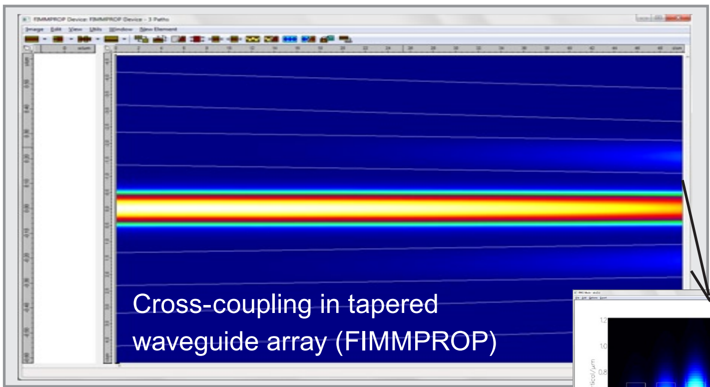
(bottom) with MMIs, (top) without

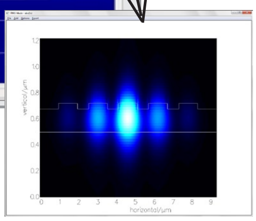


☑ Tapering and cross-coupling in I/O waveguide arrays (with FIMMPROP link)

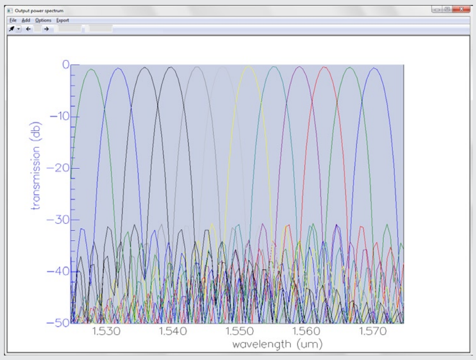
The effect of tapering in the input and output waveguides can be modelled using EPIPPROP combined with FIMMPROP. This will allow you to characterise the amount of cross-talk introduced by cross-coupling between neighbouring waveguides.

Including tapering in the simulation can reveal strong effects as shown in the transmission spectra on the right. You can see that the cross-coupling introduces a fairly high level of cross-talk, seen in the additional shoulders near the peaks in the output spectrum.

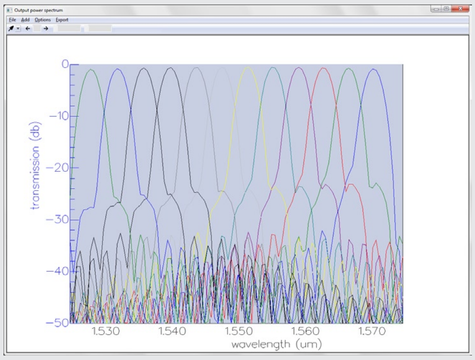




Resulting field profile



(top) without tapering



(bottom) with tapering - note the additional shoulders (cross-talk)

☑ Check out our paper on Echelle grating optimisation techniques

Based on EPIPPROP simulations and available on open access:
http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6479218

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